Stream Habitat Condition for Sites in the Panhandle National Forest

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Background

Salmon, steelhead, and bull trout stocks have been listed under the Endangered Species Act in most drainages within the interior Columbia River Basin. While many environmental factors led to the listing of these populations, habitat degradation is one of the major causes (Williams et al. 1999). Good or improving stream habitat, and protection of processes that maintain these habitats, increases the likelihood of successful adult spawning and juvenile rearing for these listed species. A useful approach for assessing the status of stream habitat condition at a given stream reach is to compare its habitat characteristics to those of streams likely to be functioning properly (Stoddard et al. 2006). The Pacfish/Infish Biological Opinion Effectiveness Monitoring Program (PIBO) uses this approach to evaluate status of stream habitat within portions of the interior Columbia River and Missouri River basins, and to also document changes in habitat conditions (e.g. "trend") over the fifteen year period of PIBO sampling (2001-2015).

Methods

Status and Trend

Determining the condition or status of an individual, or group of stream reaches is a difficult task because of the natural inherent variability in stream conditions due to geoclimatic and disturbance regimes (Ebersole et al. 1997). PIBO's approach is to compare the status of stream habitat conditions at sites in 'managed' watersheds (watersheds exposed to disturbance from various management actions) to habitat conditions at sites within 'reference', or relatively pristine, watersheds, which are used as a benchmark of expected condition. Because all streams are affected by natural disturbance, in assessing *status* we are most interested in how the range of stream habitat conditions expressed at managed sites compares to what would be expected if the stream had experienced only natural disturbance. To ascertain the status of a given site we created an index of habitat condition which accounts for some natural variability among sites and combines several stream habitat attributes (Al-Chokhachy et al. 2010). While an index is good for determining status, it may be less sensitive when detecting trend in habitat condition over time because it averages conditions of several attributes that may be more individually responsive. Therefore we estimate trends by measuring changes in individual stream habitat metrics, such as bank stability or large wood frequency, at a site over the duration of PIBO sampling (2001-2015).

Reach sampling

PIBO began collecting physical stream habitat and macroinvertebrate data at the reach scale (160-400 m stream lengths) within the interior Columbia River and Upper Missouri River basin in 2001. In 2006 we expanded to begin sampling reaches within the Upper Missouri River Basin in Montana. Approximately 300 sub-watersheds (6^{th} field HUCs) are selected each year for sampling using a random, nearly regular pattern. Over a five year period, 1300 sub-watersheds are sampled in the Columbia River basin and 250 sub-watersheds in the Missouri basin, which equates to about a third of the sub-watersheds managed by the Bureau of Land Management and the Forest Service within the study area. These sub-watersheds have been resampled on a five year rotation, and the data are used to assess status and trend of aquatic and

riparian conditions. PIBO is in the third rotation of the five year panel; in 2015, most sites have been sampled three times.

Sub-watershed and Reach Types

The sub-watersheds are divided into two groups, either "reference" (minimally managed) or "managed", based on management history (such as livestock grazing, mining, or roads). Reference sites are primarily located in wilderness areas or in sub-watersheds with no obvious mining, no recent grazing (within 30 years), minimal timber harvest (< 5%) and minimal road density (< 0.5 km/km^2). There are 254 reference sites within the study area.

Within each reference and managed sub-watershed, we randomly select an 'integrator' site located at the lowermost, low-gradient (< 3%) reach occurring on federal land. These low-gradient sites are influenced by the reaming watershed area upstream of the site and are considered the most sensitive to changes from variable sediment and flow regimes. Integrator reaches are evaluated on a 5-year rotating panel with revisits occurring 5 years after the initial visit.

In addition to our integrator sites, we sample two additional site types. The first, called 'designated monitoring areas' or DMAs, occurs within grazed sub-watersheds at sites representative of grazing impacts typical for the pasture. The second type we sample are sites on public lands upon special request of individual National Forests, BLM units, and National Parks, this site type is referred to as a contract site.

Table 1. Stream habitat attributes measured by PIBO

STREAM HABITAT ATTRIBUTES	STATUS	TREND
Average bank angle (°)	*	*
d_{50} (median substrate particle size)	*	*
Percent fine sediment (<6 mm diameter, in pool tails)	*	*
Large Wood frequency (pieces /km)	*	*
Residual pool depth (m)	*	*
Percent pool habitat	*	*
Bank stability (% bank covered with plants or rock)		*
Percent of bank with undercuts (bank angle <90°)		*
Macroinvertebrate taxa (Observed/Expected)	*	*

Field Data Collected for Status and Trend

Physical Habitat Attributes

To estimate status of physical stream habitats at each site, we focus on six stream channel attributes that (1) influence the production or survival of native salmonids; (2) are sensitive to land-use changes; and (3) can be measured consistently by observers (see Table 1). For a complete description of these variables and field methods used, see Kershner et al. (2004) and Archer et al. (2013).

Biological Attributes

To evaluate a biological component of habitat status, we sample macroinvertebrates using the protocol recommended by the Center for Monitoring and Assessment of Freshwater Ecosystems, Utah State University (Hawkins et al. 2000). Macroinvertebrates are sampled from 8 fast-water habitats per site and

combined into a composite sample. Macroinvertebrate taxa are identified by the BLM/USU National Aquatic Monitoring Center in Logan, UT.

Attributes Used for Trend

We estimate trend using the same six physical stream habitat attributes and one biological attribute (macroinvertebrate O/E) used for status, plus two additional metrics, bank stability and percent undercut banks (see Table 1).

Calculating Physical Habitat Index Scores to assess Status

To evaluate the status of stream habitat conditions at a given site, we first developed an index score for each physical habitat attribute. We began construction of the index by using multiple linear regression to explain inherent differences among sites. To account for local differences in stream type and geographic location we included landscape 'predictor' variables, such as average precipitation, percent forested and slope of the valley (see Table 2), as well as some measures of stream power (reach gradient, and catchment area) as covariates in the regression models. We selected the best multiple regression model to fit each attribute using data only from the reference sub-watersheds (n = 217; 10% of reference were set aside to verify model performance) to provide 'expected' stream habitat conditions in the absence of land management activities (Al-Chokhachy 2010).

Table 2. Landscape predictor variables used in model development

Catchment area (km^2)
Average precipitation (m)
Slope of valley along reach (%)
Percent forested along reach (%)
Drainage density in catchment (km/km^2)
Reach Gradient (%)
Elevation (m)
Dominant geology type (categorical)

We then compared observed conditions to what would be expected after controlling for local and landscape characteristics. This can be visualized as a regression line through a series of points, with the regression line predicting expected conditions and the distance between each point and the line representing deviations from expected conditions, or residuals. We created an index for each stream habitat attribute by re-scaling these residuals (distance from the predicted line) from 0-10, using the 5^{th} and 95^{th} percentiles of the residuals at reference reaches as floor (index score = 0) and ceiling (index score =10) values. This process was repeated for each physical stream habitat attribute used to estimate status in Table 1. A site scored high (closer to 10) if the measure of observed habitat condition was better than expected and low if it was lower than expected (closer to 0). The distribution of index scores for a particular area represents the scatter around the line. Sites with sub-watershed areas < 3 km^2, > 300 km^2 were excluded from the analysis because they were outside of the range of conditions present at reference sites.

For reference sites, residuals are considered to represent natural variation due to natural disturbances, such as fire, beetle kill, climate, or variance unexplained by our models. For managed sites, residuals are considered to represent a combination of natural factors, unexplained variation in the model, and a management effect. A significant difference between the reference prediction and the actual managed site index scores can potentially be attributed to management.

To create an overall index of physical habitat condition for a site, we summed the individual attribute scores included in the index and then rescaled this sum from 0-100. For complete details and a better understanding, see Al-Chokhachy et al. 2010.

Calculating a Macroinvertebrate Taxa Index O/E score to assess Status

To assess biological status at each site, we compared the macro-invertebrate taxa 'observed' at managed reaches (O) to the assemblages 'expected' to be found in relatively pristine reference reaches (E) based on a modeling exercise similar to that used for stream habitat (see Hawkins et al. 2000 for more specific details). The PIBO O/E model was developed using macro-invertebrate samples collected at 201 reference reaches between 2001 and 2005; taxa were identified by the BLM/USU National Aquatic Monitoring Center. The O/E index score for each reach was estimated by dividing the number of expected taxa by the number of observed taxa. A monitored site with an O/E value of '1' indicates that all of the macroinvertebrate taxa expected at a reference site (with similar geographical setting and characteristics) were found at the site, while a value of '0' indicates that none of the taxa expected were found. Scores > 0.8 are generally considered similar to references reaches. Scores > 1 are either equivalent to what would be expected at a reference location or may have an enhanced insect community as a result of some type of enrichment.

Displaying Status

Box plots, Histograms, and Line Graphs

We use boxplots, histograms, and line graphs to visually compare the distribution of index scores at managed reaches to that of reference reaches. Boxplots show the median and range (25^{th} and 75^{th} percent) of index values (see Fig.1). We also combine a histogram with a line graph to display the distribution of index values for the managed reaches (histogram) compared to the expected values at reference reaches (the line graph) (see Fig. 2). If a large percentage of the histogram lies under the line, this indicates conditions are similar at managed and reference reaches.

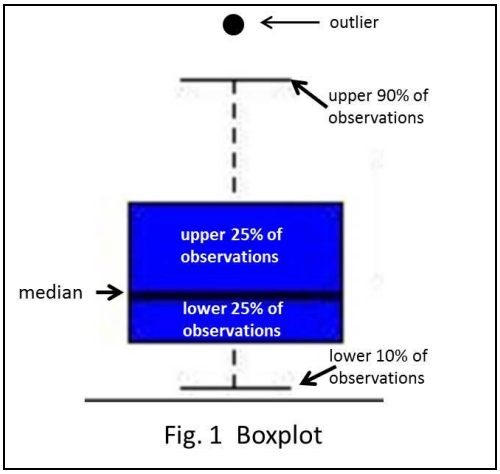


Fig.1. Description of a boxplot distribution.

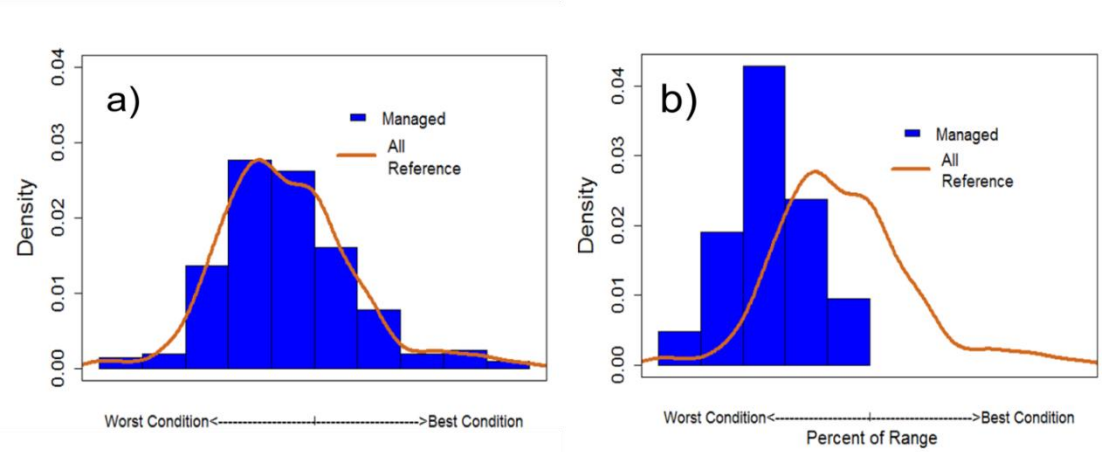


Fig.2. Distribution of index values for managed (histogram) and reference (line) sites. (a) an example of managed and reference sites with similar habitat conditions; and (b) managed sites skewed towards lower condition compared to reference sites.

Summary Tables

Managed reaches within the 'area of interest' (e.g., forest-wide; a 4th field HUC) were analyzed by comparing them to reference reaches at three landscape scales: (1) reference reaches within the area of interest (if present); (2) reference reaches within the ecoregion; and (3) reference reaches throughout the PIBO study area (n = 254). The ecoregions included were the Blue Mountains, Idaho Batholith, Middle Rockies, Canadian Rockies, and Northern Rockies (for details, see Omernick 1987). If at least one managed site was located within a given ecoregion, then we included all reference sites from that ecoregion in our analysis. At least five managed reaches for a given area were necessary to run the analysis. In addition, at least five reference reaches had to be present in the area of interest in order to make a comparison at that scale.

We used a t-test, assuming variance was not the same in managed and reference, to determine if differences between index scores for each metric at managed and reference reaches were statistically significant; a p-value < 0.10 was considered significant.

Estimating Trends in Stream Habitat Conditions

Summary Tables

To estimate trends in stream habitat condition, we used actual measured values (and not index scores) for eight stream habitat attributes (see Table 1). We compared data collected at the first sampling visit with data from the last visit using the Wilcoxon signed rank summed test, a non-parametric statistical test that evaluates repeated measurements at the same site to determine if there has been a change in the metric value. A p-value < 0.10 indicates that the change is significant. Desirable changes could be either in a positive or negative direction, as, for example, increased bank stability or fewer fine sediments. The desired direction of change (+ or -) for each habitat attribute is shown in the summary tables. We also indicate the general direction of change across reference sites sampled by PIBO. Summary tables also show the mean value for each attribute for the first and last sampling events, and the percent change in the metric over the evaluation period.

Map of Study Area

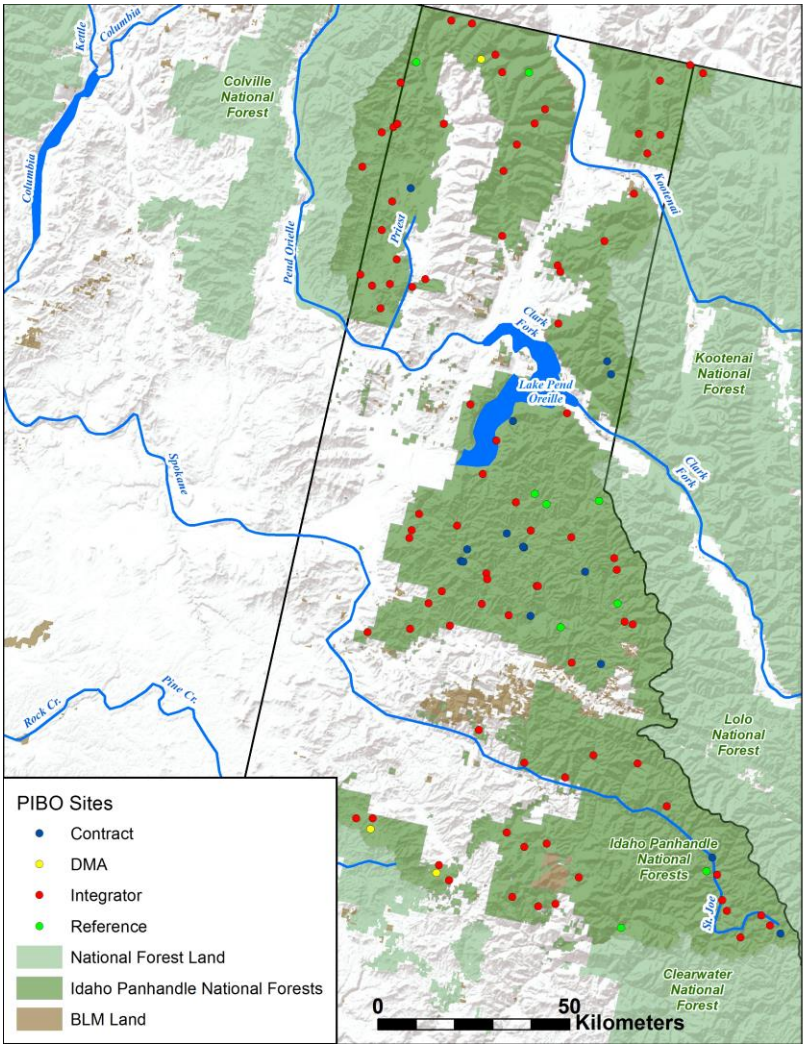


Fig.3. Map of the study area.

Interpreting the Data—Important Considerations

Navigating to Graphs and Tables

To easily find and navigate to graphs and tables in the results section, go to View>Navigation Pane and check the Navigation Pane box.

Uses

The status and trend information PIBO provides for physical and biological stream habitat attributes has several practical applications for planning, NEPA analyses, and consultation for listed fishes.

Land management plan development, amendments, or revisions

Land management plan development, amendments, or revisions usually require descriptions of current status and trends in aquatic habitat conditions across the planning area, whether forest- or field office-wide. In addition, for planning purposes the overall condition of lands in the planning area can be compared to conditions at a broader scale, such as the basin or ecoregion. This is the scale of analysis for which PIBO data is designed, with a sufficient sample size to make reasonable and easily defensible conclusions.

Range of Natural Variation

Often, the land management planning process includes the range of natural variation of ecosystem characteristics under historic disturbance regimes as an important context for evaluating current and future desired conditions. The PIBO 'reference' reaches sampled in wilderness and other areas not heavily influenced by human disturbances can be used to estimate the expected distribution of stream conditions in the absence of management-induced disturbance. Incorporating a distribution of reference reach conditions recognizes that even relatively pristine streams may have poor habitat conditions due to natural disturbance regimes. Subsequently, distribution of habitat conditions in reference areas can be compared to the distribution of stream conditions in managed sites as a measure of status. If the distribution of your managed site conditions mimics the reference condition distribution, it can be assumed that managed sites fall within the range of natural variation. Conversely, if the distributions of reference and managed sites are different, then management may have had an effect on stream condition. The Summary of Index Scores tables show p-values that indicate whether managed index scores are statistically different than reference index scores.

Plan Monitoring and Evaluation

Plan monitoring provides managers status and trend information required to evaluate progress toward meeting objectives and to determine need for changes or revisions to planning documents. Because the area of analysis for plan monitoring is at least as large as the forest, field office, or other comparable administrative unit (but may be larger as appropriate), PIBO status and trend data provide valuable information for use in plan evaluation of aquatic ecosystems.

Species-specific Analyses

Status and trends of aquatic habitats at the sub-basin scale (4th Field HUC) are especially useful for ecological sustainability analyses of focal fish species (bull trout, interior redband, cutthroat, or salmon). These fish populations are typically addressed by both U.S. Fish and Wildlife Service and National Marine Fisheries Service at the sub-basin scale, and the viability status for each Designated Population Segment and Ecologically Significant Unit is first described based on sub-basin boundaries.

Caveats

Pay attention to scale

PIBO status and trend data are useful at the planning area scale or in broader contexts, such as sub-basin, basin, or ecoregion. However, to interpret status or trend with confidence, a sufficient number of monitored managed sites must occur in the area of interest at those scales. As reach sample size drops

below ~ 10, use caution when interpreting the data, as statistical confidence in both the distributions and individual values is not as great. Non-significant differences between managed and reference sites at low sample sizes do not necessarily mean that management had no effect.

However, even at a single site, PIBO status and trend data can be helpful. For instance, if habitat condition scores at a site are on the lower end of the range of that observed at references sites, this could suggest that more conservative management or additional restoration activities are needed to maintain or improve habitat conditions. PIBO data also can be integrated with monitoring information collected locally to better inform project decisions.

Ground-truthing

PIBO data and analyses indicate status or trends of stream habitat attributes, but not necessarily their causes. Field visits or local knowledge are essential to assess possible reasons for poor habitat conditions and the nature of on-the-ground impacts to a specific site. For example, poor habitat conditions could be due to natural factors such as erosive soils or recent fires, as well as management such as roads or grazing. Field visits can also be used to verify how well the index scores reflect actual habitat conditions. Some error surrounds individual index score estimates because the models cannot incorporate all environment factors. In addition, our landscape predictors are GIS-derived, which also involves some associated error.

Unit-Scale: Integrators

Panhandle NF

Status

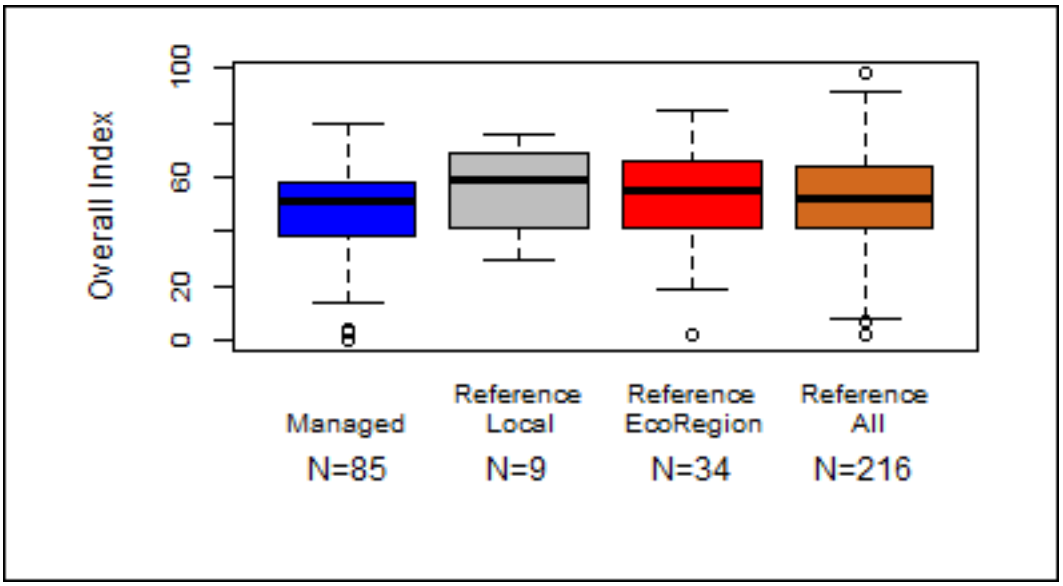


Figure 1. Overall Index values across the Panhandle NF. Median and range of index values for managed sites, reference sites within the area of evaluation, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

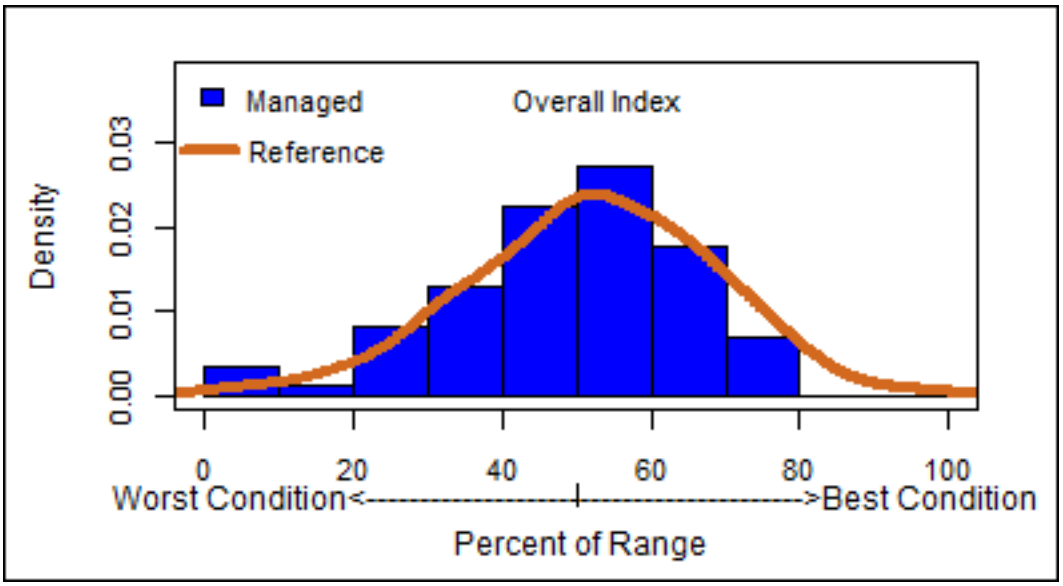


Figure 2. Overall Index values across the Panhandle NF. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

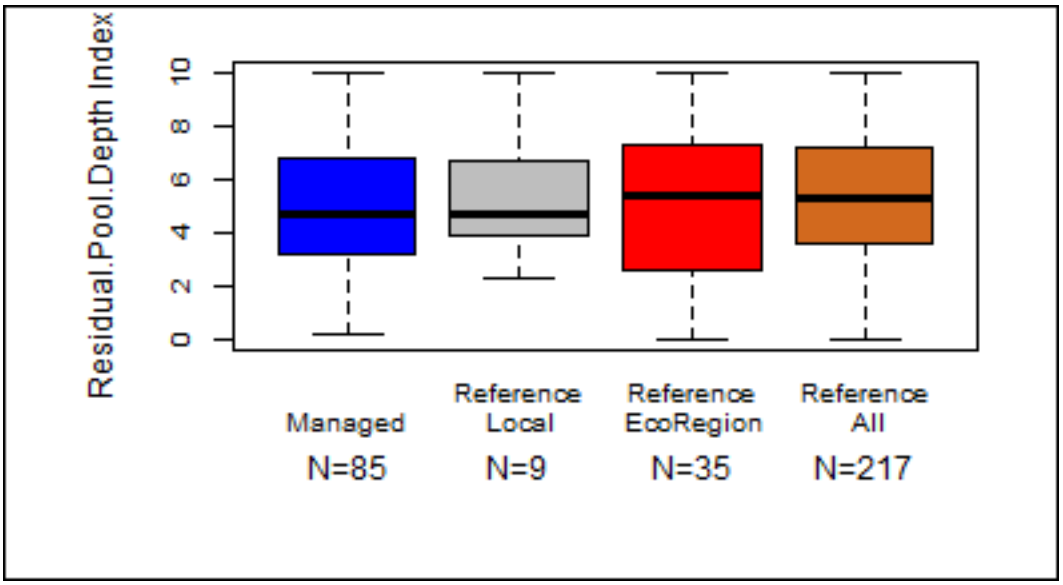


Figure 3. Residual Pool Depth Index values across the Panhandle NF. Median and range of index values for managed sites, reference sites within the area of evaluation, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

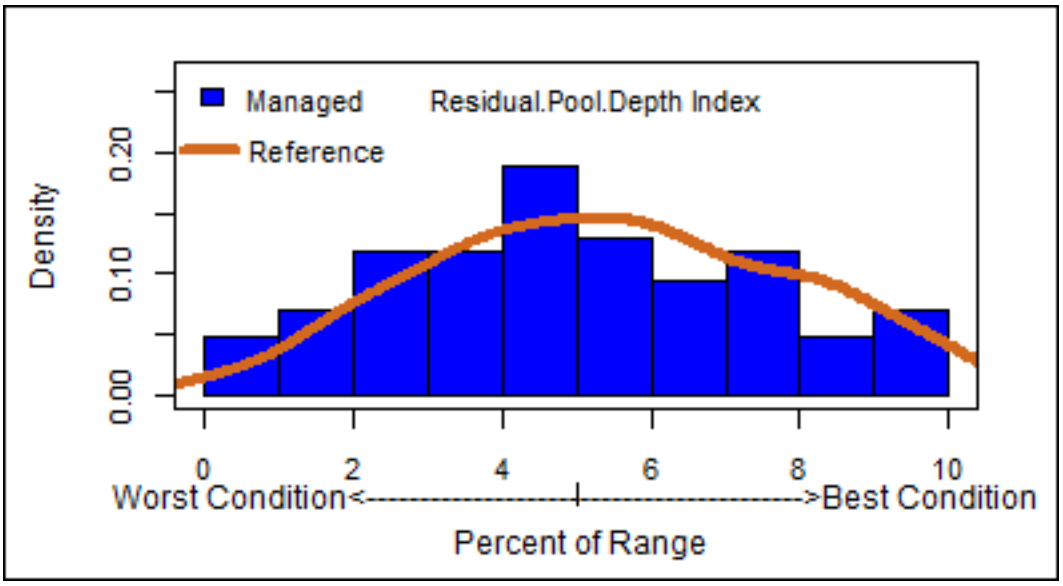


Figure 4. Residual Pool Depth Index values across the Panhandle NF. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

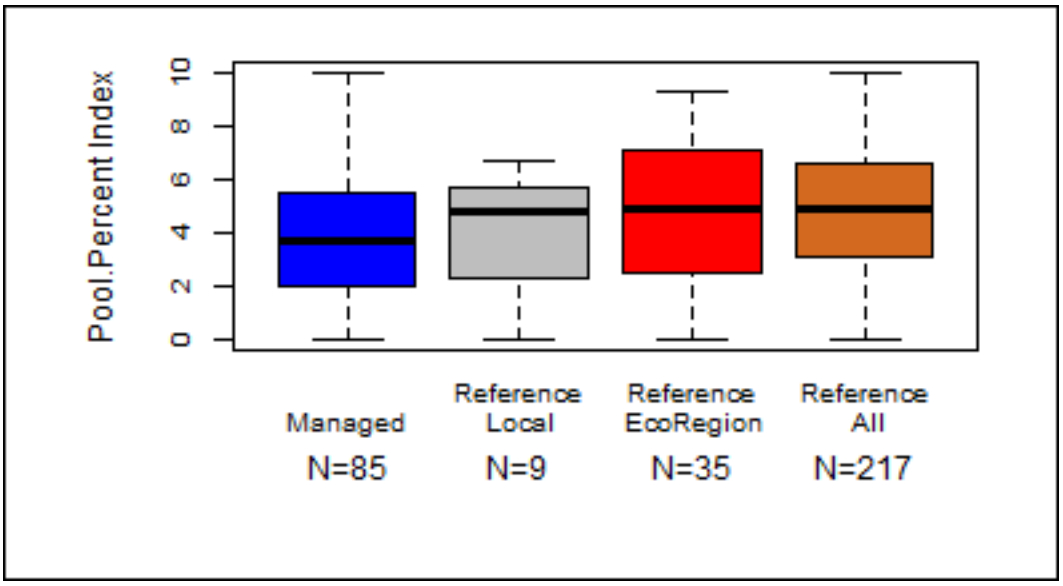


Figure 5. Pool Percent Index values across the Panhandle NF. Median and range of index values for managed sites, reference sites within the area of evaluation, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

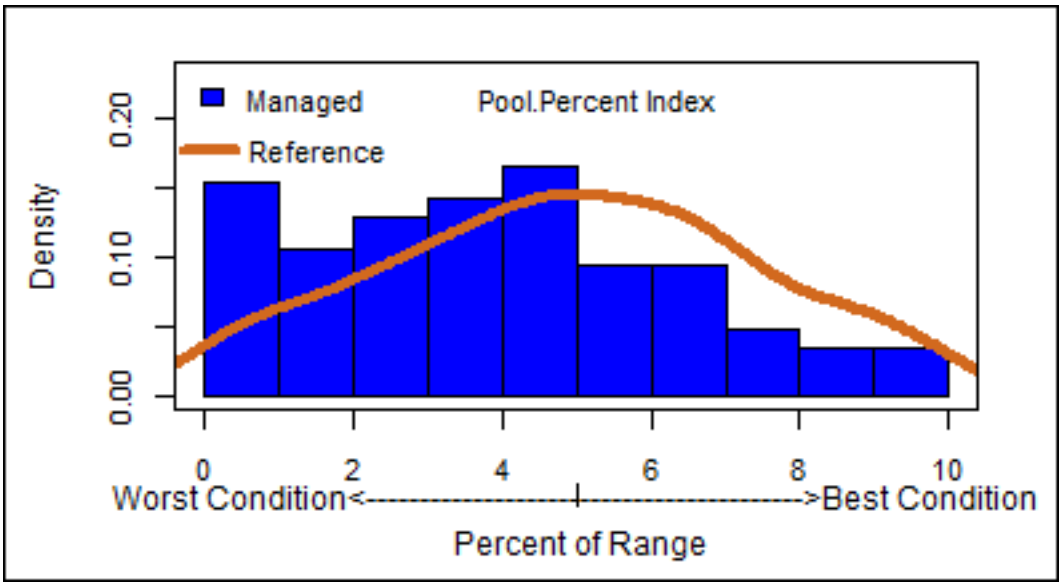


Figure 6. Pool Percent Index values across the Panhandle NF. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

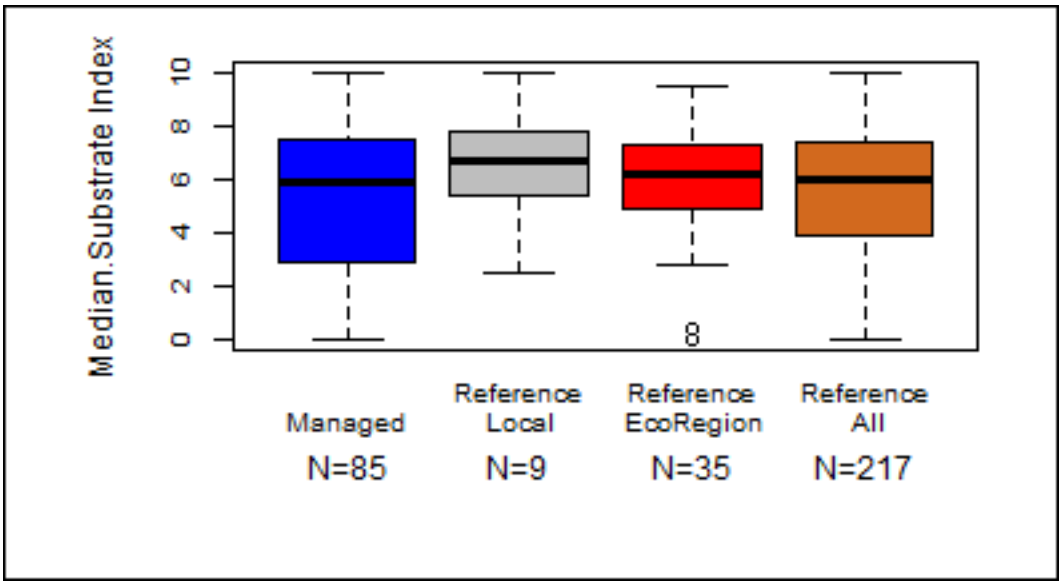


Figure 7. Median substrate Index values across the Panhandle NF. Median and range of index values for managed sites, reference sites within the area of evaluation, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

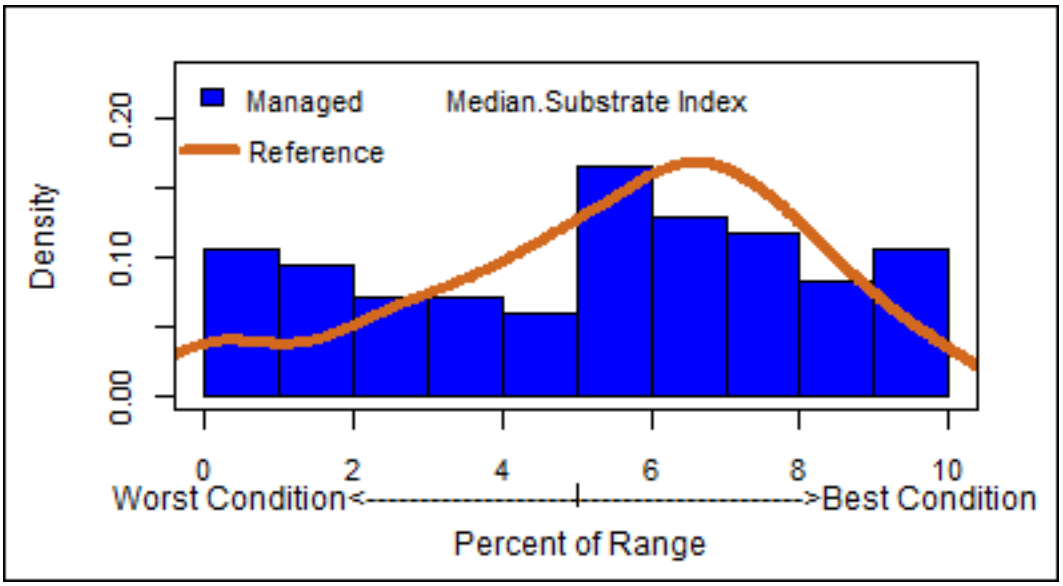


Figure 8. Median substrate Index values across the Panhandle NF. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

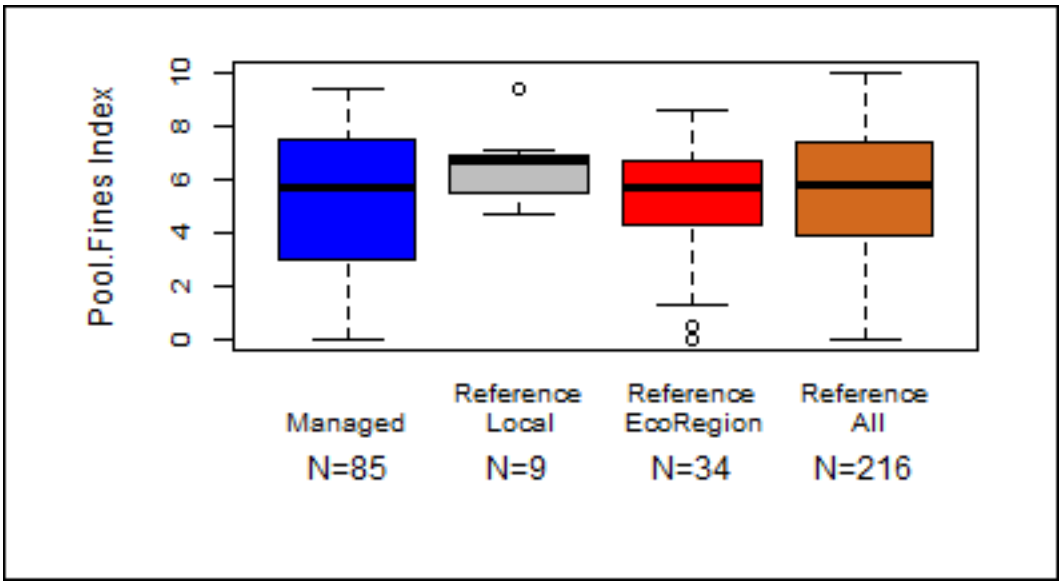


Figure 9. Pool Fines < 6 mm Index values across the Panhandle NF. Median and range of index values for managed sites, reference sites within the area of evaluation, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

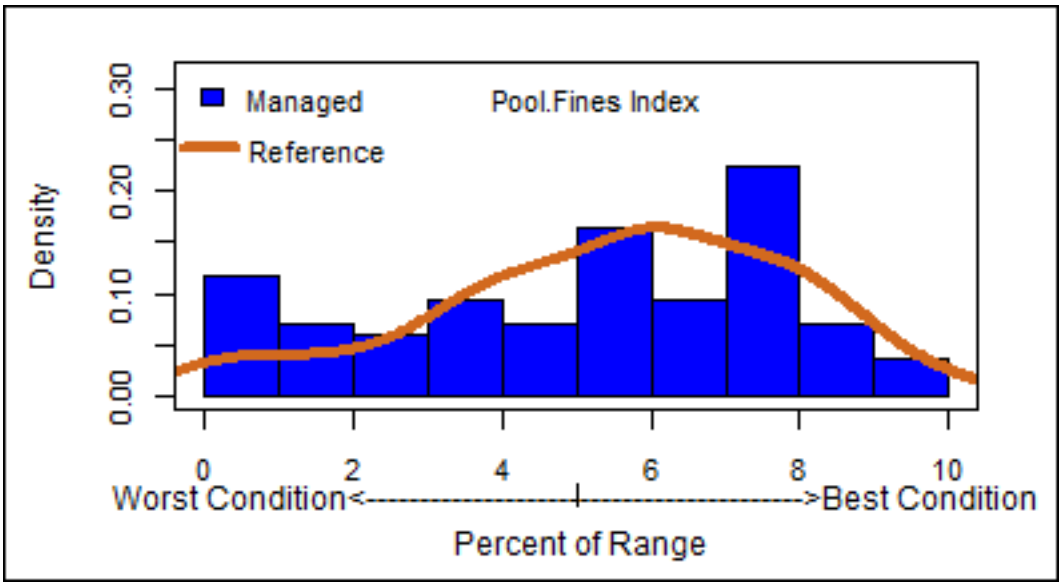


Figure 10. Pool Fines < 6 mm Index values across the Panhandle NF. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

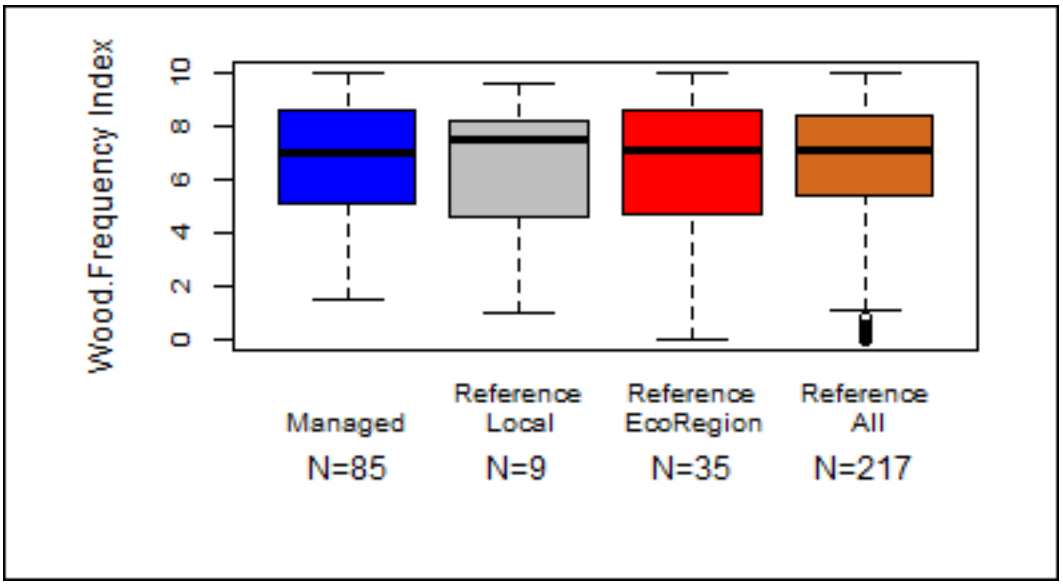


Figure 11. Wood Frequency Index values across the Panhandle NF. Median and range of index values for managed sites, reference sites within the area of evaluation, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

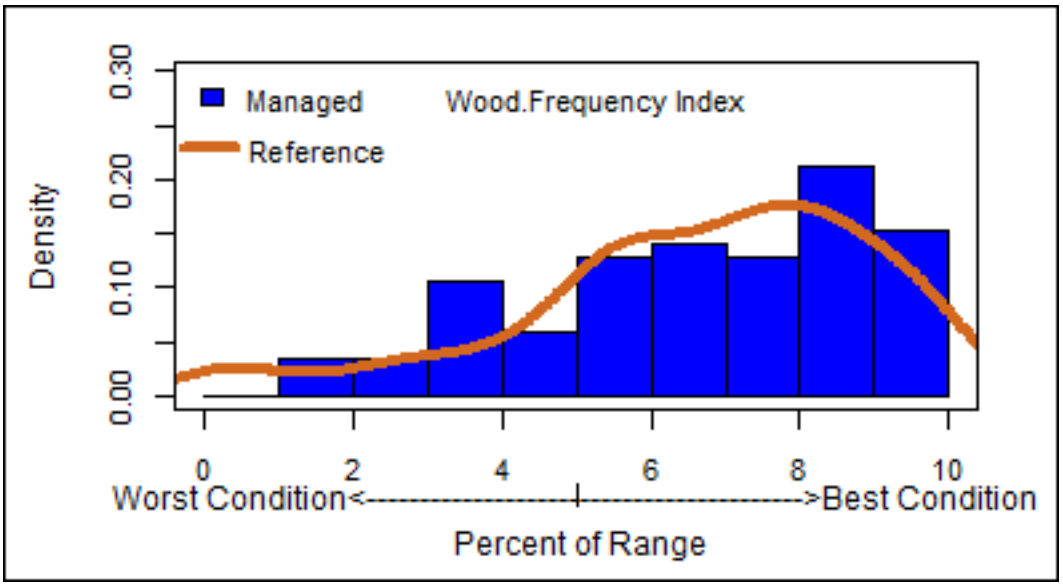


Figure 12. Wood Frequency Index values across the Panhandle NF. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

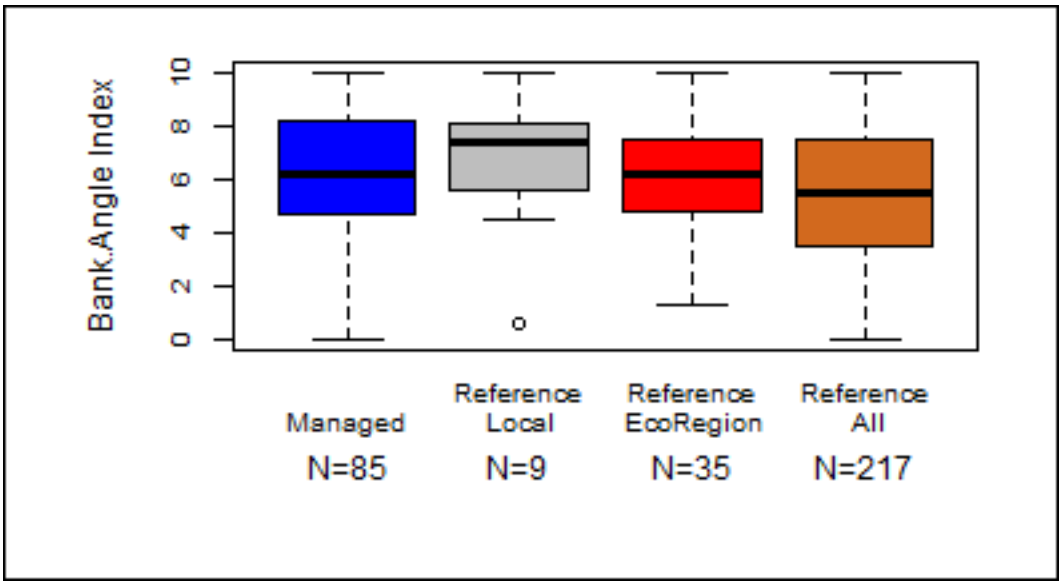


Figure 13. Bank Angle Index values across the Panhandle NF. Median and range of index values for managed sites, reference sites within the area of evaluation, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

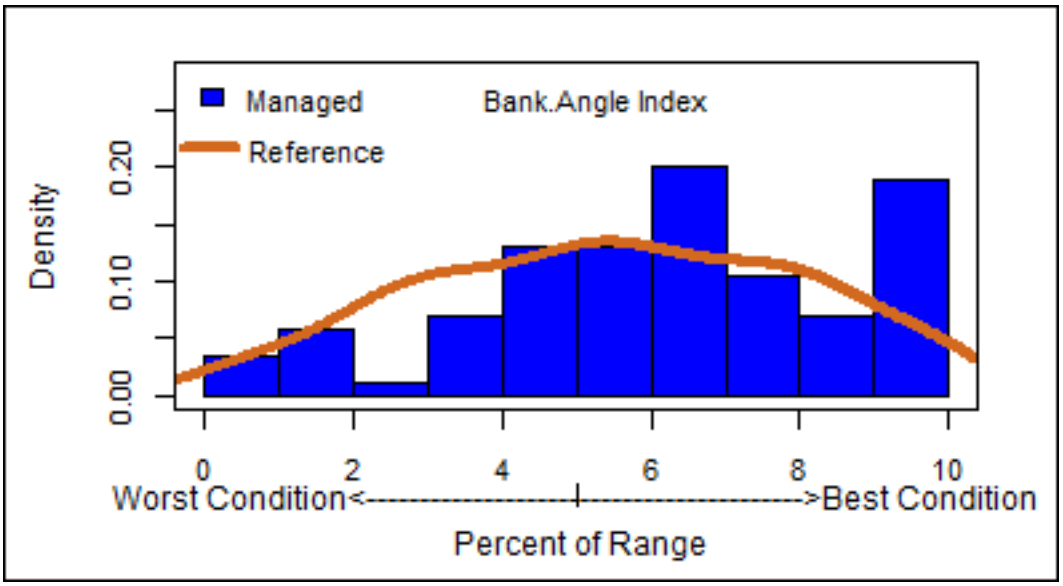


Figure 14. Bank Angle Index values across the Panhandle NF. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

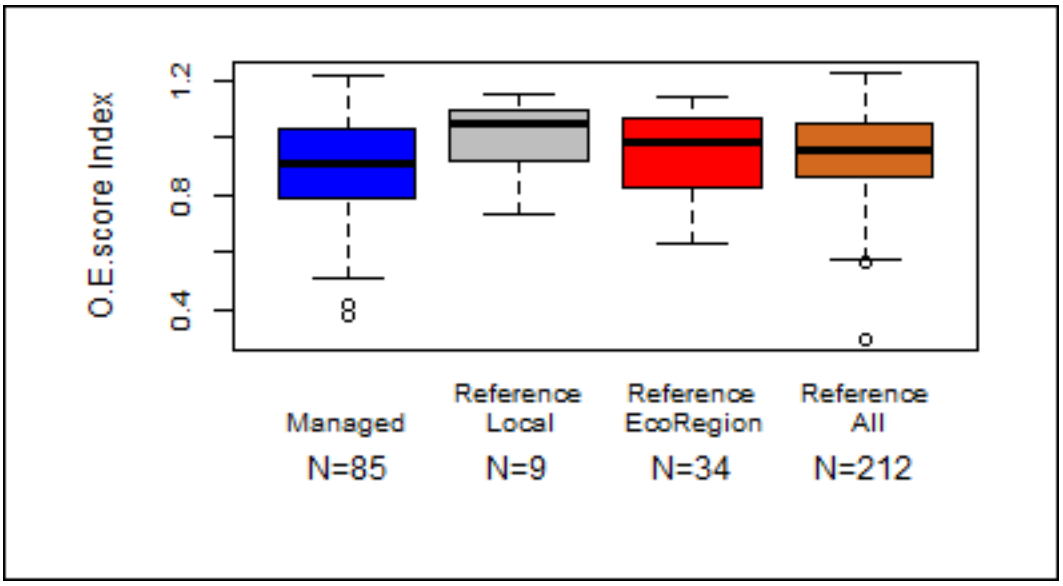


Figure 15. O/E Macroinvertebrate score Index values across the Panhandle NF. Median and range of index values for managed sites, reference sites within the area of evaluation, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

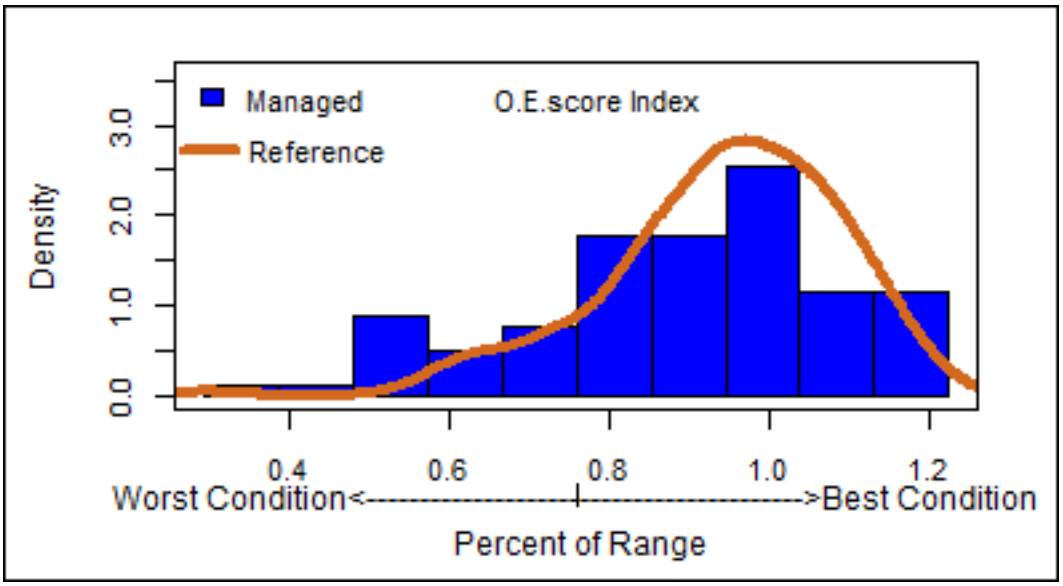


Figure 16. O/E Macroinvertebrate score Index values across the Panhandle NF. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

Table1. Summary of Index Scores--Panhandle NF; N=sample size, p-value=significance (0.05), sd=standard deviation, ci=95% confidence interval

InterestArea	Metric	Indexscore	N	pvalue	sd	ci
Managed	Overall	48.31	85	NA	16.65	3
Reference Local	Overall	55.38	9	0.254	16.65	10.32
Reference Eco Region	Overall	51.68	34	0.357	18.31	5.32
Reference All	Overall	52.02	216	0.084	16.69	1.88
Managed	Residual.Pool.Depth	4.99	85	NA	2.44	0.44
Reference Local	Residual.Pool.Depth	5.36	9	0.68	2.48	1.54
Reference Eco Region	Residual.Pool.Depth	5.23	35	0.676	2.87	0.82
Reference All	Residual.Pool.Depth	5.41	217	0.178	2.4	0.27
Managed	Pool.Percent	3.92	85	NA	2.5	0.45
Reference Local	Pool.Percent	3.94	9	0.985	2.45	1.52
Reference Eco Region	Pool.Percent	4.81	35	0.1	2.73	0.78
Reference All	Pool.Percent	4.93	217	p<0.01	2.49	0.28
Managed	Median.Substrate	5.2	85	NA	2.98	0.54
Reference Local	Median.Substrate	6.54	9	0.109	2.12	1.31
Reference Eco Region	Median.Substrate	5.84	35	0.18	2.08	0.59
Reference All	Median.Substrate	5.56	217	0.322	2.51	0.28
Managed	Pool.Fines	5.09	85	NA	2.72	0.49
Reference Local	Pool.Fines	6.38	9	0.042	1.48	0.92
Reference Eco Region	Pool.Fines	5.25	34	0.723	2.01	0.58
Reference All	Pool.Fines	5.49	216	0.239	2.39	0.27
Managed	Wood.Frequency	6.63	85	NA	2.29	0.41
Reference Local	Wood.Frequency	6.21	9	0.693	3.05	1.89
Reference Eco Region	Wood.Frequency	6.09	35	0.337	3	0.86
Reference All	Wood.Frequency	6.62	217	0.959	2.38	0.27
Managed	Bank.Angle	6.18	85	NA	2.57	0.46
Reference Local	Bank.Angle	6.54	9	0.719	2.86	1.77
Reference Eco Region	Bank.Angle	5.94	35	0.627	2.35	0.67
Reference All	Bank.Angle	5.45	217	0.029	2.54	0.29
Managed	O.E.score	0.89	85	NA	0.19	0.03
Reference Local	O.E.score	1	9	0.06	0.14	0.09
Reference Eco Region	O.E.score	0.95	34	0.057	0.14	0.04
Reference All	O.E.score	0.94	212	0.018	0.15	0.02

Trend

Table 2 .Trend in stream habitat attributes across the Panhandle NF Subbasin including: Overall_Index score, O.E. (Observed/Expected macroinvertebrate score), VegStab (bank stability), UnCutPct (percent undercut banks), LWFrq (large wood frequency), Bank Angle, PTFines6 (percent fines in pool tails), D50 (median substrate size), RPD (residual pool depth), and PoolPct (percent pools). Refer to page 5 of methods (Heading: 'Summary Tables') for further explanation. Time1 = mean during first visit; Time2 = mean value for last visit; Percent Change = Percent change in the mean values between the first and last visit; Sample size = number of observations with repeat visits; Negative Number = Number of sites where actual measurement was lower on last visit; Positive Number = Number of sites where actual measurement was higher in last visit; None Number = Number of sites where last visit and first visit values were equal; P-value = Significance test; Desired Direction = direction of change in the mean, which can be either + or -; Actual Change = actual direction of change in the mean, which can be not statistically significant (NS), + or -.

Metric	Time1 Value	Time2 Value	Percent Change	Sample Size	Negative Number	Positive Number	No Change Number	P-value	Desired Direction	Actual Change
Overall_Index	46.04	50.53	9.8	82	30	51	1	0.005	+	+
O.E.	0.88	0.89	0.9	83	41	42	0	0.957	+	NS
VegStab	77.22	81.86	6	83	30	52	1	0.026	+	+
UnCutPct	32.66	36.76	12.5	83	33	50	0	0.026	+	+
LWFrq	276.65	363.88	31.5	83	26	57	0	0	+	+
BankAngle	108.93	106.01	-2.7	83	45	31	7	0.112	-	NS
PTFines6	24.22	21.92	-9.5	82	47	33	2	0.211	-	NS
D50	0.054	0.058	7.5	83	30	46	7	0.18	+	NS
RPD	0.37	0.36	-2.6	83	40	43	0	0.723	+	NS
PoolPct	41.3	43.58	5.5	83	35	48	0	0.44	+	NS

Basin-Scale: Integrators

Priest

Status

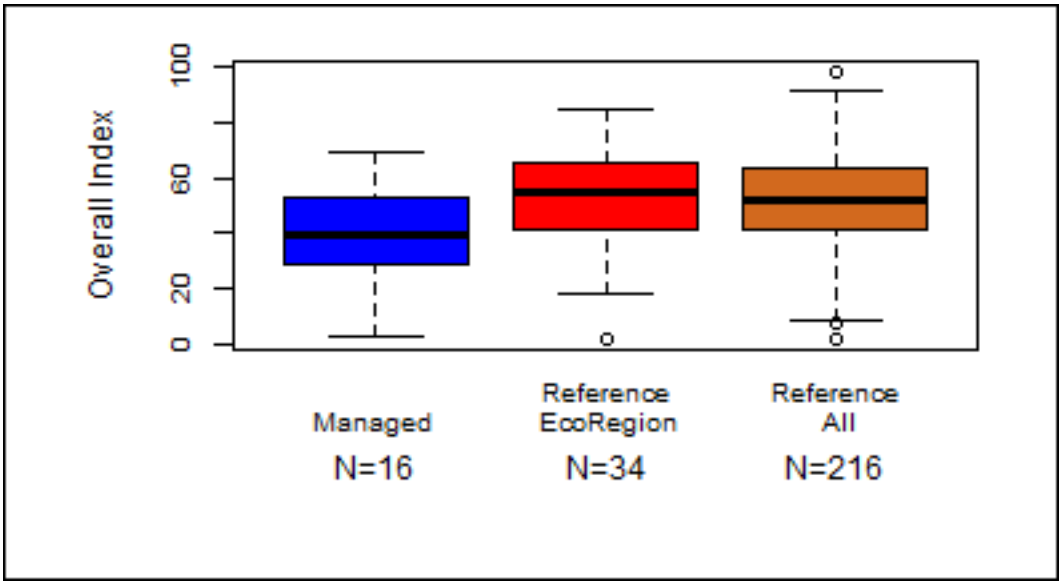


Figure 1. Overall Index values across the Priest. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

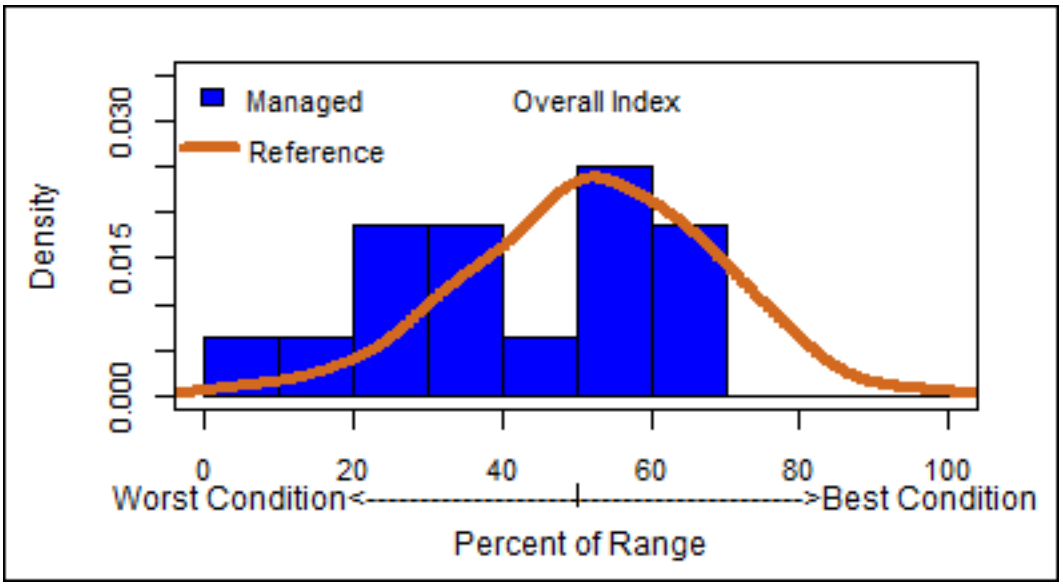


Figure 2. Overall Index values across the Priest. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

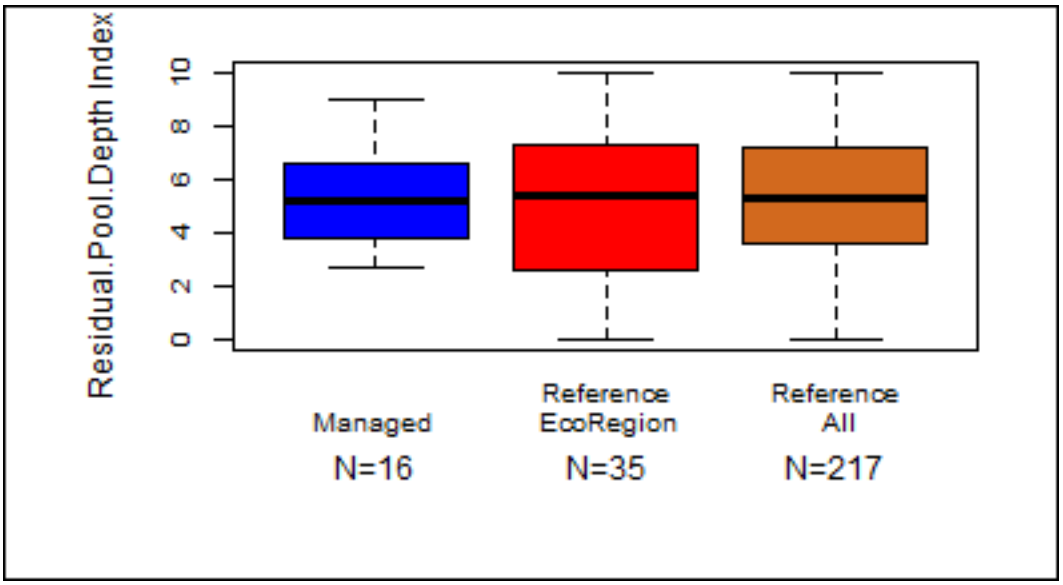
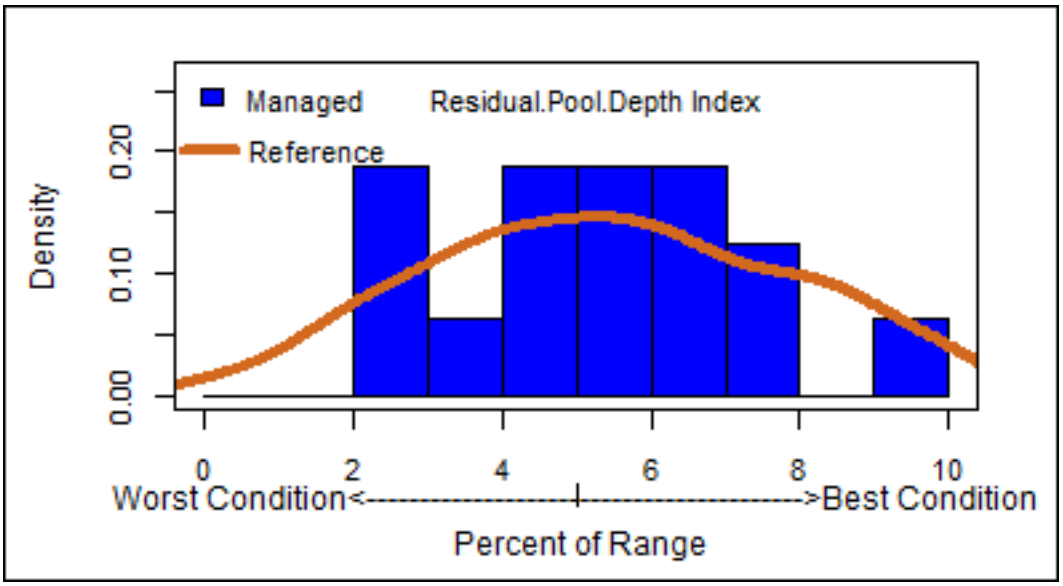


Figure 3. Residual Pool Depth Index values across the Priest. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.



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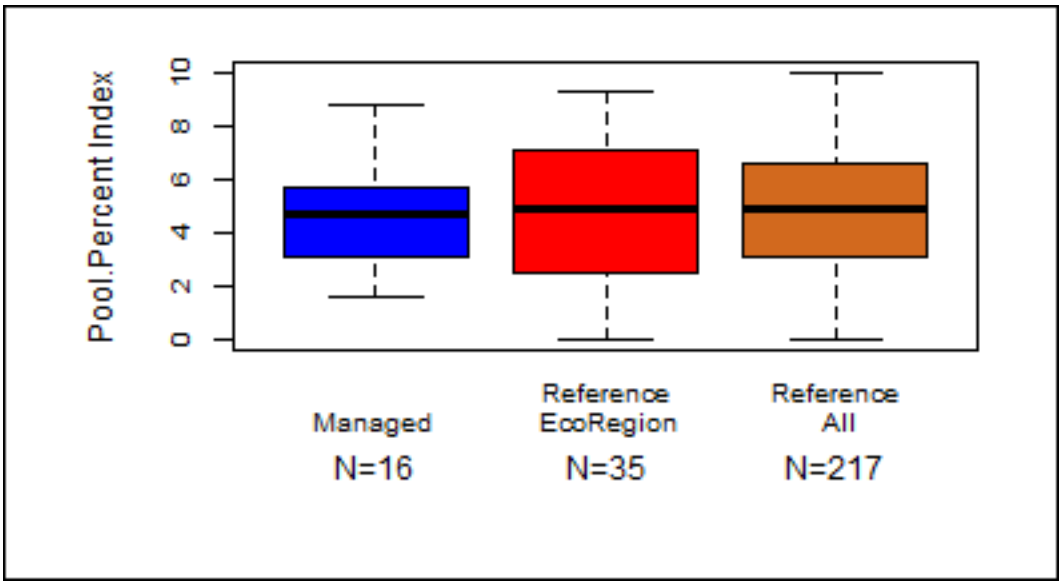
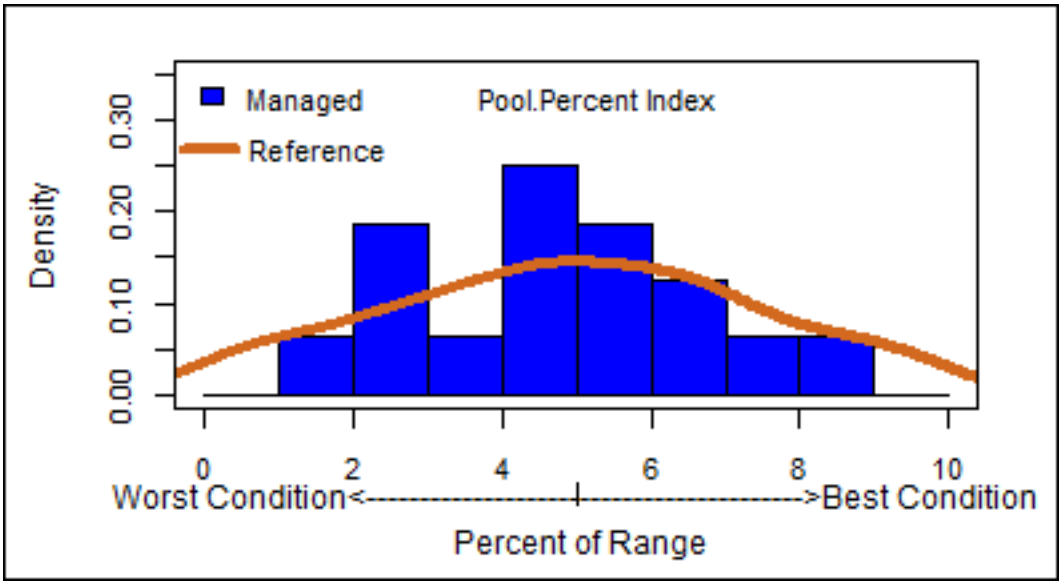


Figure 5. Pool Percent Index values across the Priest. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.



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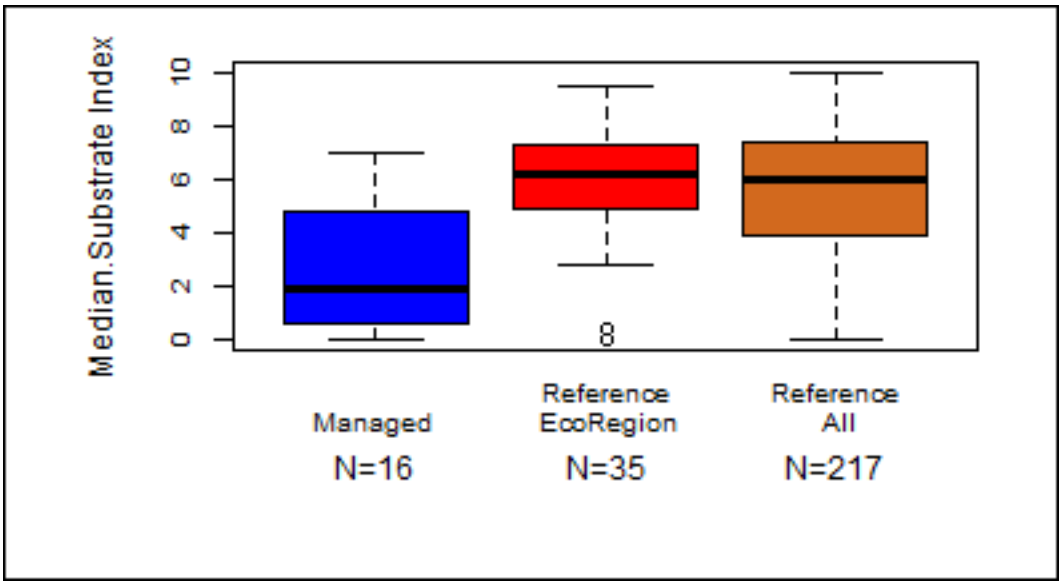
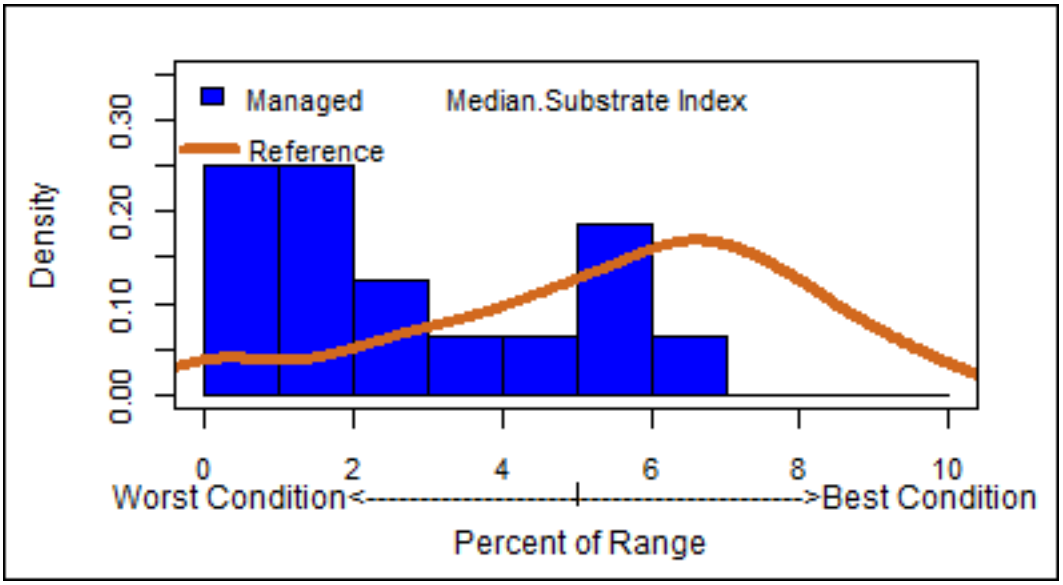


Figure 7. Median substrate Index values across the Priest. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.



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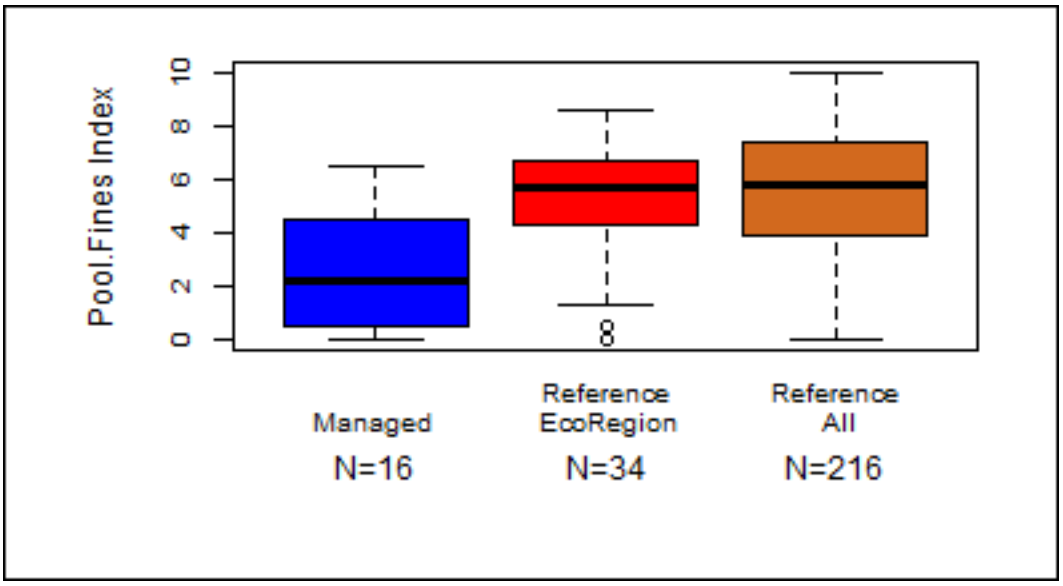
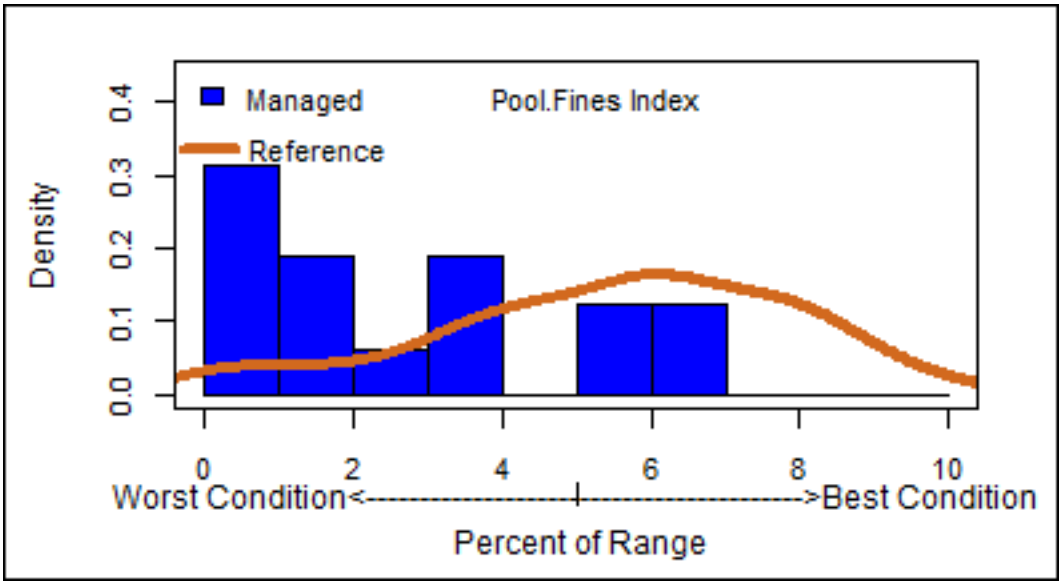


Figure 9. Pool Fines < 6 mm Index values across the Priest. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.



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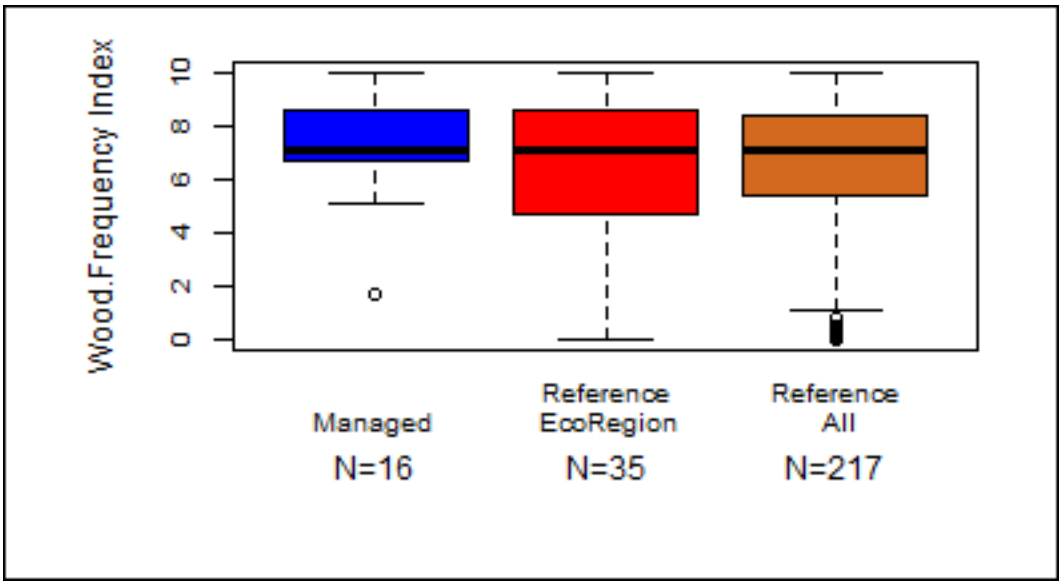
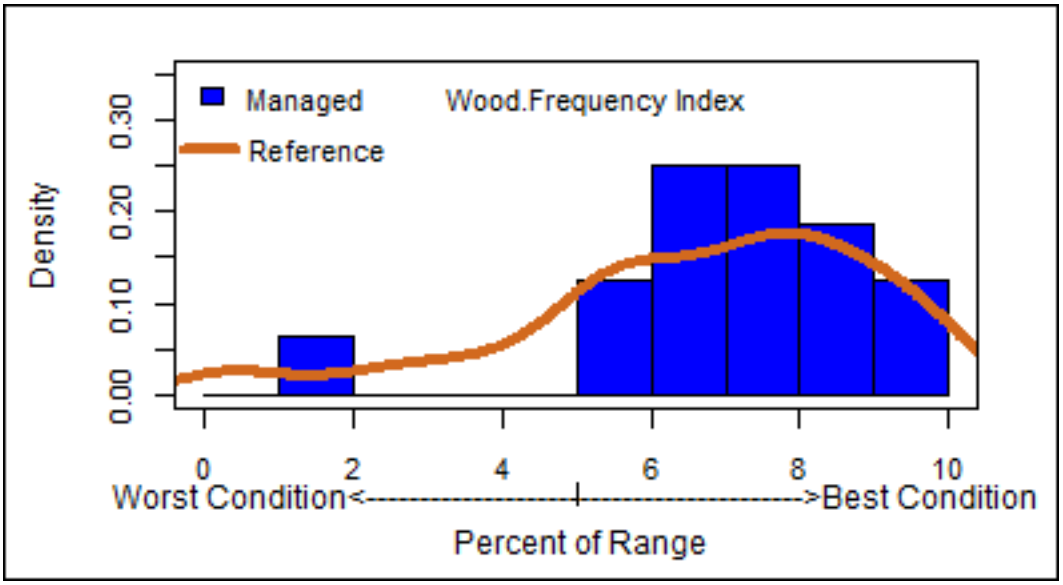


Figure 11. Wood Frequency Index values across the Priest. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.



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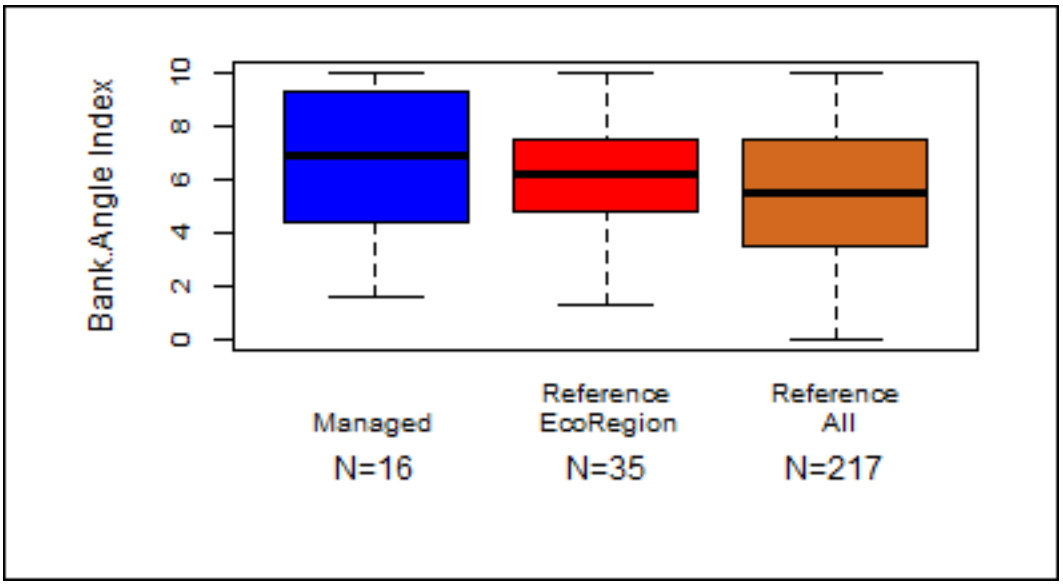

Figure 13. Bank Angle Index values across the Priest. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

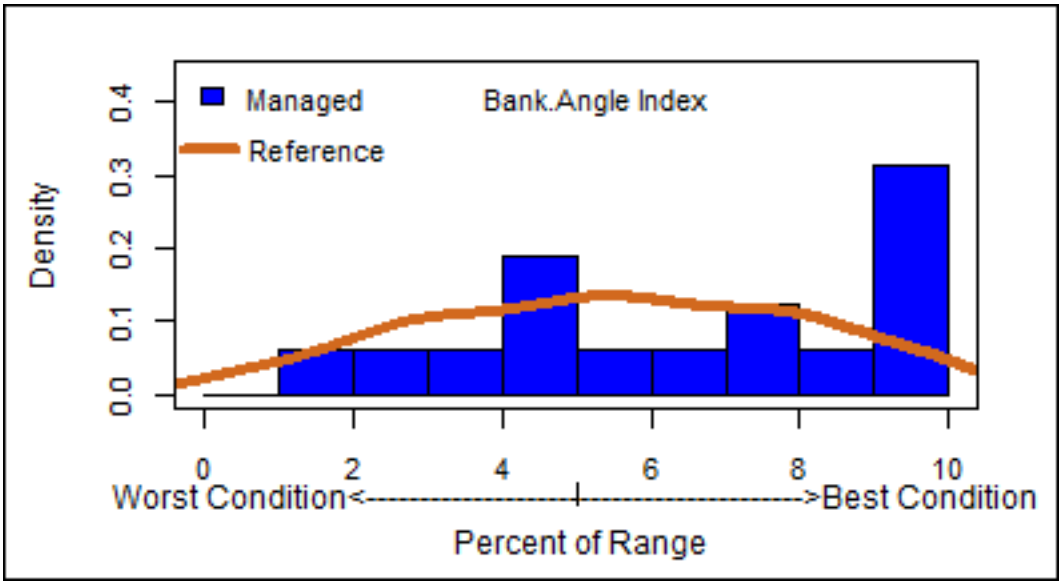

Figure 14. Bank Angle Index values across the Priest. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

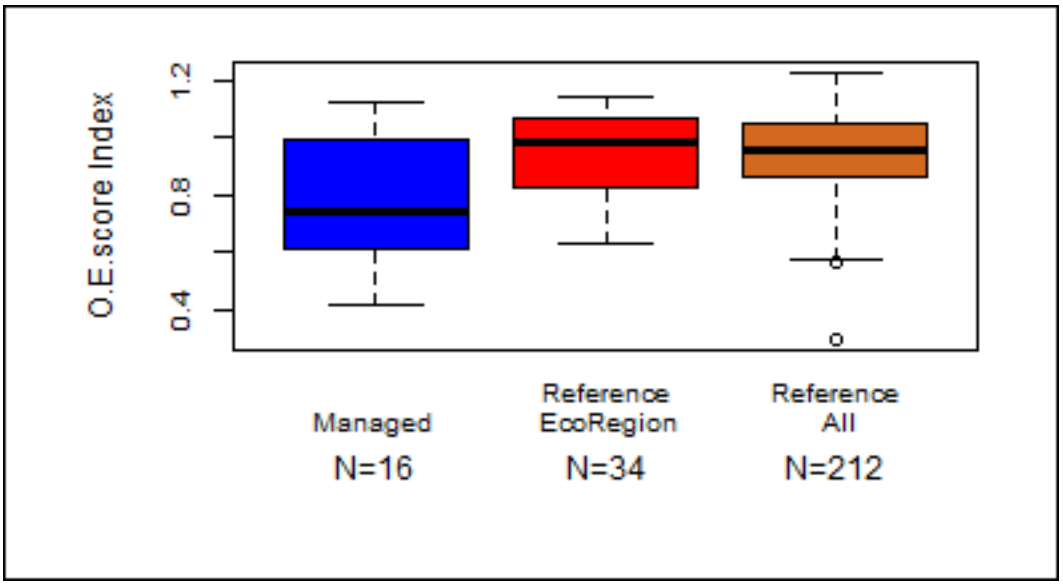

Figure 15. O/E Macroinvertebrate score Index values across the Priest. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

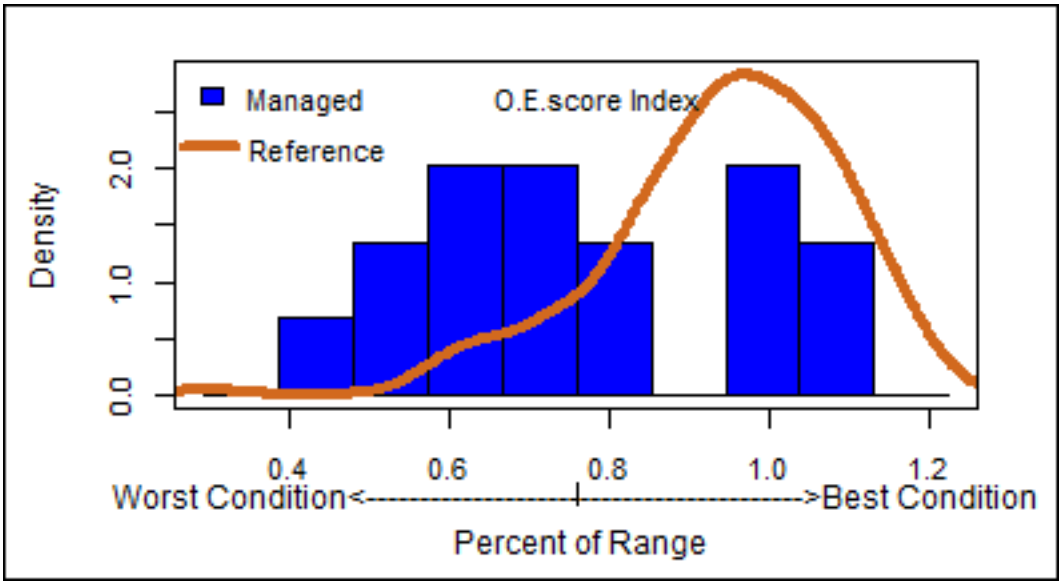

Figure 16. O/E Macroinvertebrate score Index values across the Priest. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

Table1. Summary of Index Scores--Priest; N=sample size, p-value=significance (0.05), sd=standard deviation, ci=95% confidence interval

InterestArea	Metric	Indexscore	N	pvalue	sd	ci
Managed	Overall	39.83	16	NA	18.62	8.16
Reference Local	Overall	NA	<3	NA	NA	NA
Reference Eco Region	Overall	51.68	34	0.044	18.31	5.32
Reference All	Overall	52.02	216	0.021	16.69	1.88
Managed	Residual.Pool.Depth	5.38	16	NA	1.9	0.83
Reference Local	Residual.Pool.Depth	NA	<3	NA	NA	NA
Reference Eco Region	Residual.Pool.Depth	5.23	35	0.826	2.87	0.82
Reference All	Residual.Pool.Depth	5.41	217	0.94	2.4	0.27
Managed	Pool.Percent	4.68	16	NA	1.96	0.86
Reference Local	Pool.Percent	NA	<3	NA	NA	NA
Reference Eco Region	Pool.Percent	4.81	35	0.849	2.73	0.78
Reference All	Pool.Percent	4.93	217	0.639	2.49	0.28
Managed	Median.Substrate	2.57	16	NA	2.34	1.02
Reference Local	Median.Substrate	NA	<3	NA	NA	NA
Reference Eco Region	Median.Substrate	5.84	35	p<0.01	2.08	0.59
Reference All	Median.Substrate	5.56	217	p<0.01	2.51	0.28
Managed	Pool.Fines	2.62	16	NA	2.32	1.02
Reference Local	Pool.Fines	NA	<3	NA	NA	NA
Reference Eco Region	Pool.Fines	5.25	34	p<0.01	2.01	0.58
Reference All	Pool.Fines	5.49	216	p<0.01	2.39	0.27
Managed	Wood.Frequency	7.15	16	NA	1.99	0.87
Reference Local	Wood.Frequency	NA	<3	NA	NA	NA
Reference Eco Region	Wood.Frequency	6.09	35	0.141	3	0.86
Reference All	Wood.Frequency	6.62	217	0.32	2.38	0.27
Managed	Bank.Angle	6.58	16	NA	2.8	1.23
Reference Local	Bank.Angle	NA	<3	NA	NA	NA
Reference Eco Region	Bank.Angle	5.94	35	0.434	2.35	0.67
Reference All	Bank.Angle	5.45	217	0.136	2.54	0.29
Managed	O.E.score	0.78	16	NA	0.21	0.09
Reference Local	O.E.score	NA	<3	NA	NA	NA
Reference Eco Region	O.E.score	0.95	34	p<0.01	0.14	0.04
Reference All	O.E.score	0.94	212	p<0.01	0.15	0.02

Trend

Table 2 .Trend in stream habitat attributes across the Priest Subbasin including: Overall_Index score, O.E. (Observed/Expected macroinvertebrate score), VegStab (bank stability), UnCutPct (percent undercut banks), LWFrq (large wood frequency), Bank Angle, PTFines6 (percent fines in pool tails), D50 (median substrate size), RPD (residual pool depth), and PoolPct (percent pools). Refer to page 5 of methods (Heading: 'Summary Tables') for further explanation. Time1 = mean during first visit; Time2 = mean value for last visit; Percent Change = Percent change in the mean values between the first and last visit; Sample size = number of observations with repeat visits; Negative Number = Number of sites where actual measurement was lower on last visit; Positive Number = Number of sites where actual measurement was higher in last visit; None Number = Number of sites where last visit and first visit values were equal; P-value = Significance test; Desired Direction = direction of change in the mean, which can be either + or -; Actual Change = actual direction of change in the mean, which can be not statistically significant (NS), + or -.

Metric	Time1 Value	Time2 Value	Percent Change	Sample Size	Negative Number	Positive Number	No Change Number	P-value	Desired Direction	Actual Change
Overall_Index	38.53	42.28	9.7	16	8	8	0	0.301	+	NS
O.E.	0.8	0.73	-9.1	16	9	7	0	0.408	+	NS
VegStab	81.51	84.08	3.2	16	5	10	1	0.281	+	NS
UnCutPct	46.62	47.19	1.2	16	8	8	0	0.796	+	NS
LWFrq	332.59	462.09	38.9	16	3	13	0	0.005	+	+
BankAngle	93.81	95.75	2.1	16	7	8	1	0.629	-	NS
PTFines6	50.32	50.9	1.2	16	9	7	0	0.836	-	NS
D50	0.0184	0.0142	-23.1	16	7	7	2	0.433	+	NS
RPD	0.38	0.43	12.3	16	6	10	0	0.569	+	NS
PoolPct	56.84	70.41	23.9	16	5	11	0	0.034	+	+

Status

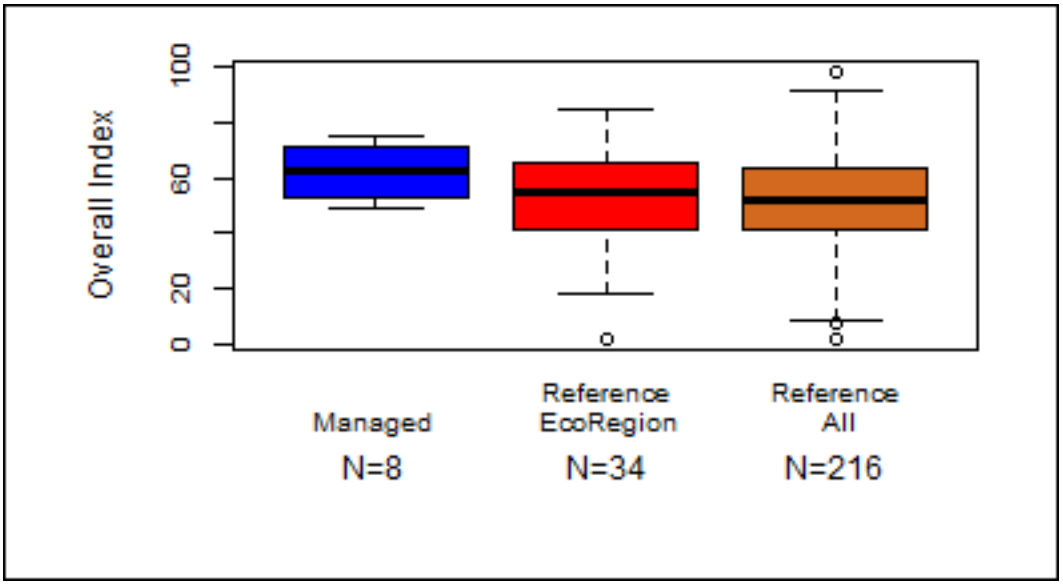

Figure 1. Overall Index values across the Lower Kootenai. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

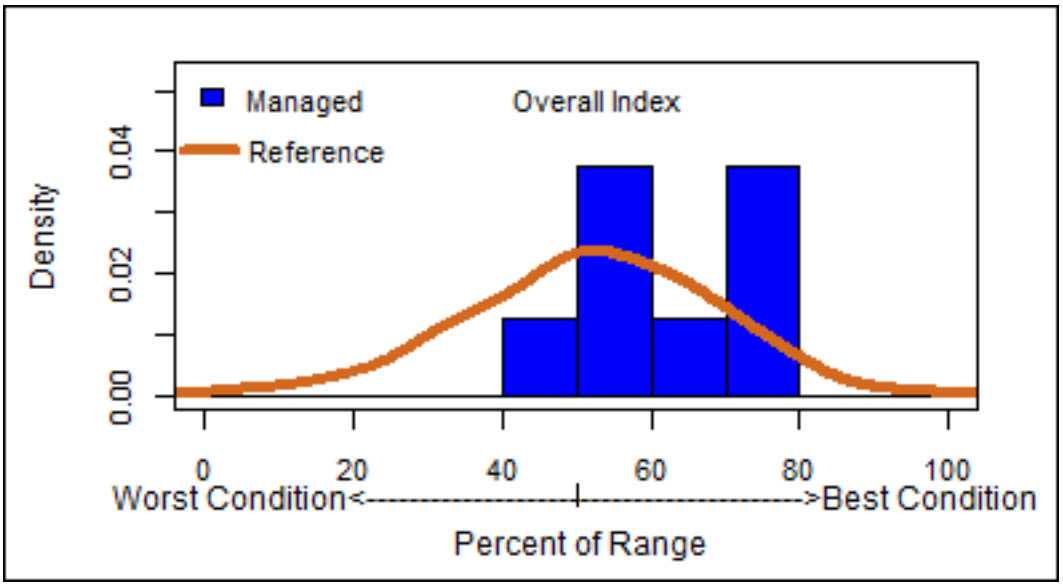

Figure 2. Overall Index values across the Lower Kootenai. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

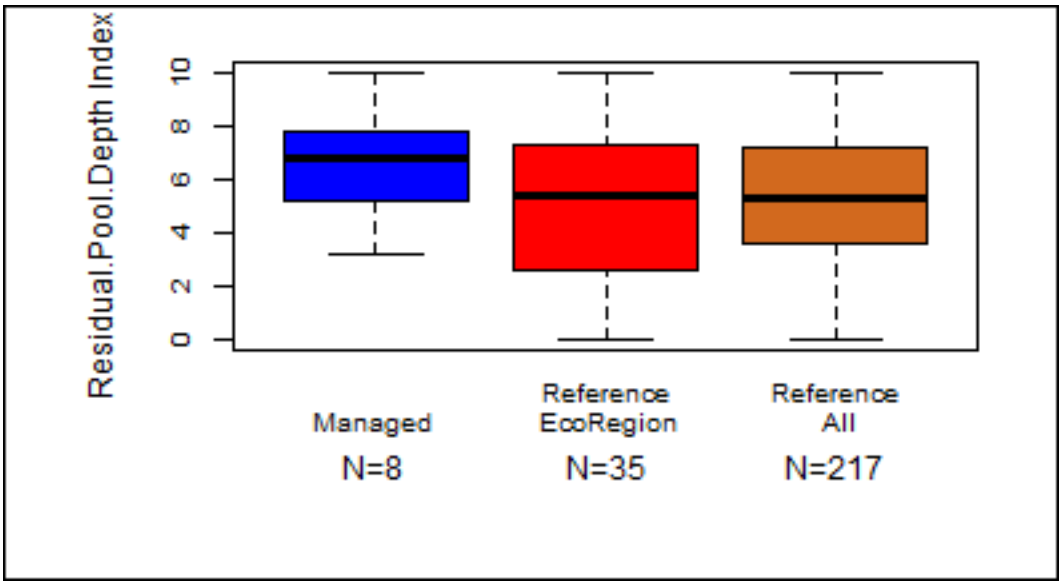

Figure 3. Residual Pool Depth Index values across the Lower Kootenai. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

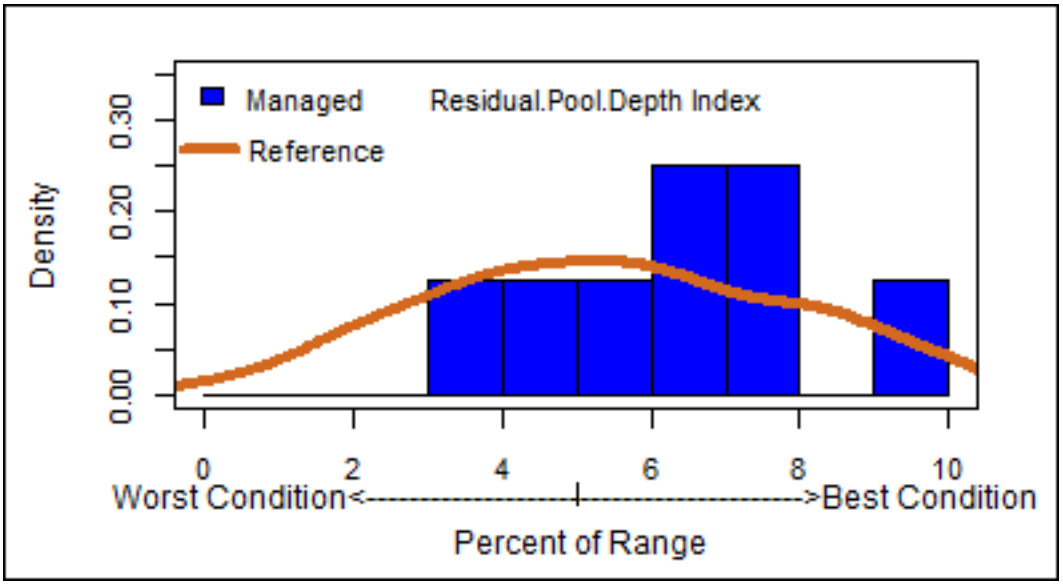

Figure 4. Residual Pool Depth Index values across the Lower Kootenai. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

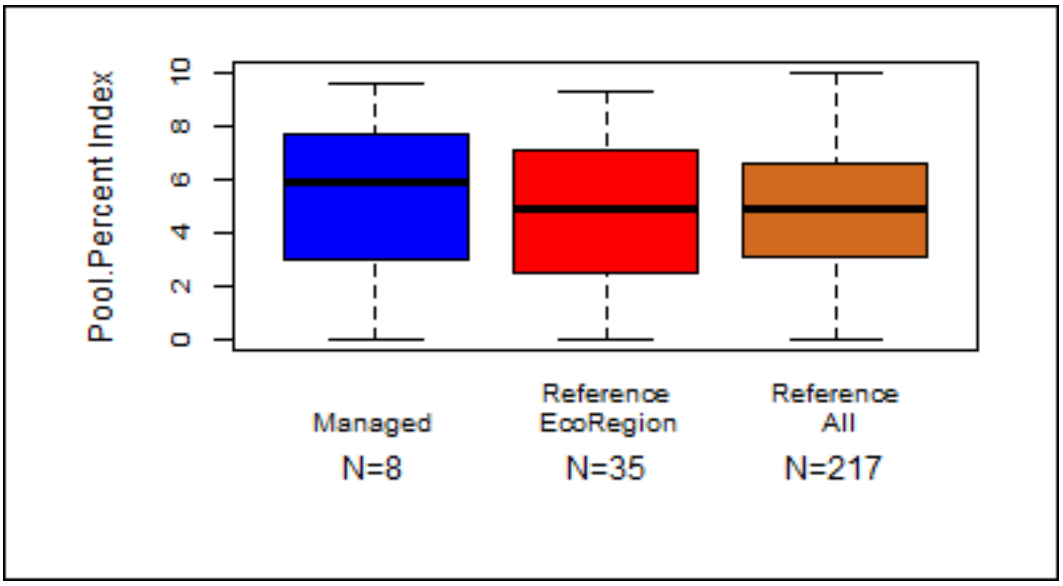

Figure 5. Pool Percent Index values across the Lower Kootenai. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

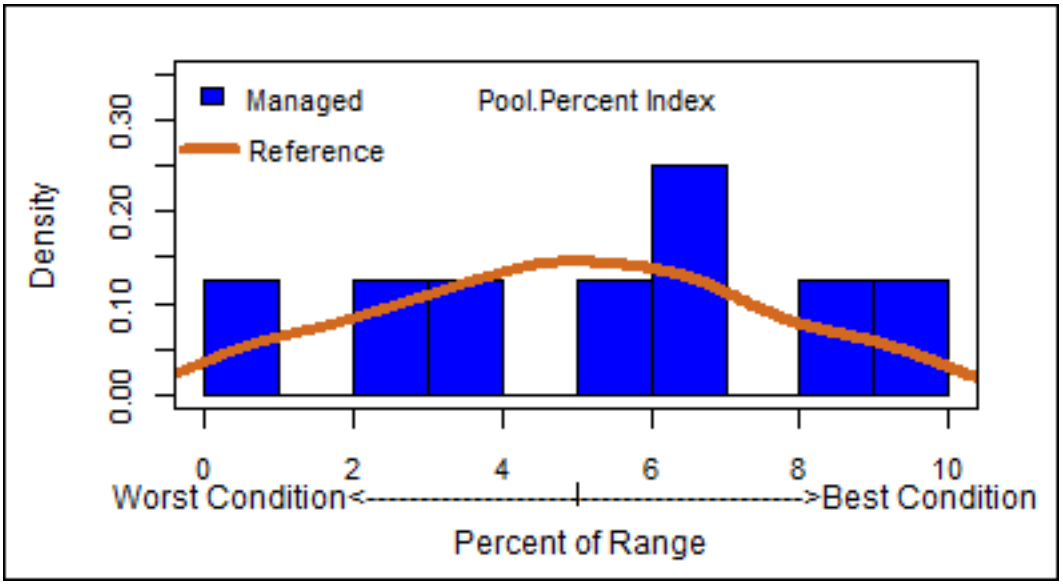

Figure 6. Pool Percent Index values across the Lower Kootenai. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

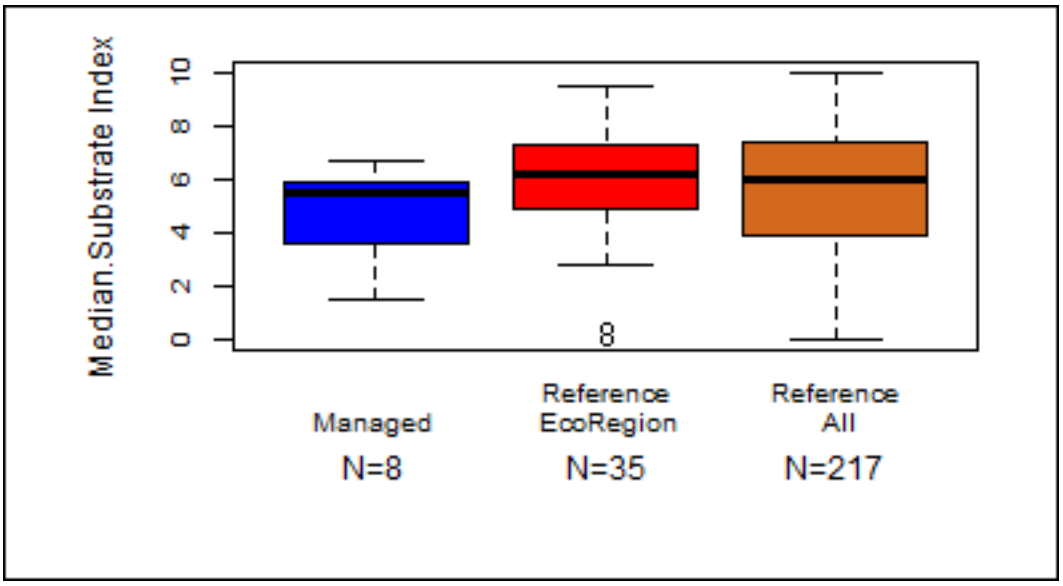

Figure 7. Median substrate Index values across the Lower Kootenai. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

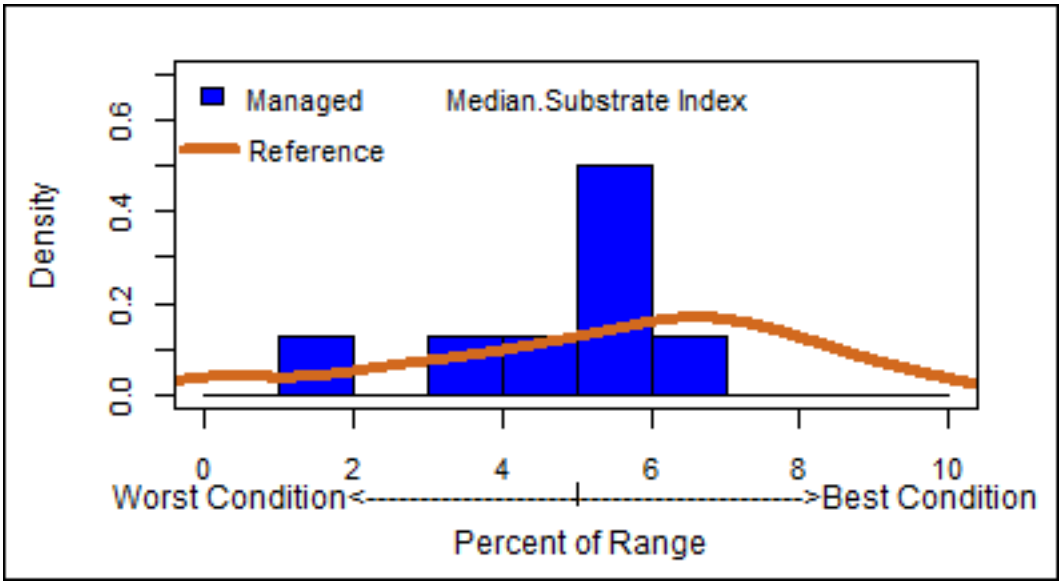

Figure 8. Median substrate Index values across the Lower Kootenai. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

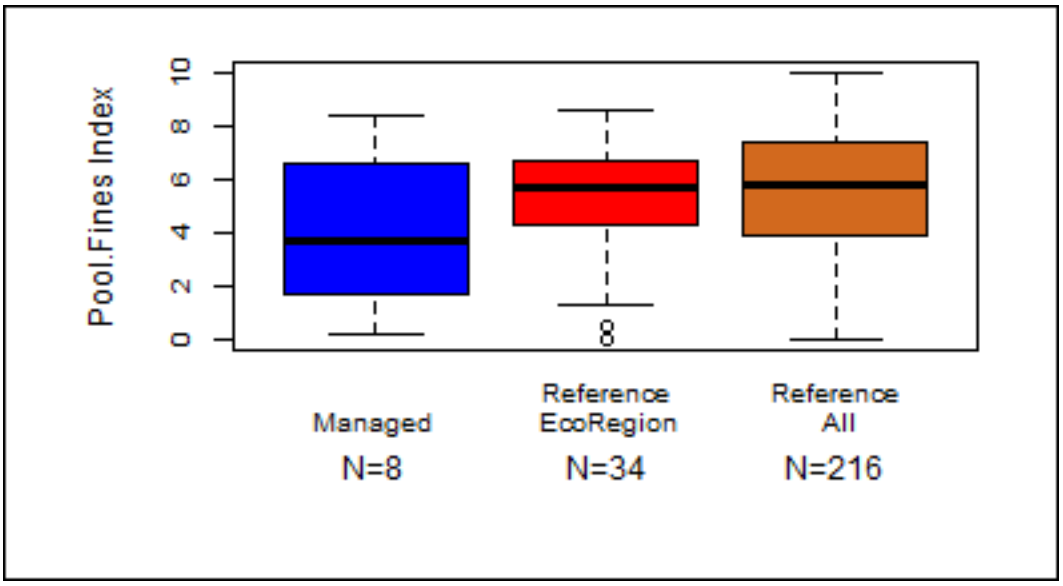

Figure 9. Pool Fines < 6 mm Index values across the Lower Kootenai. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

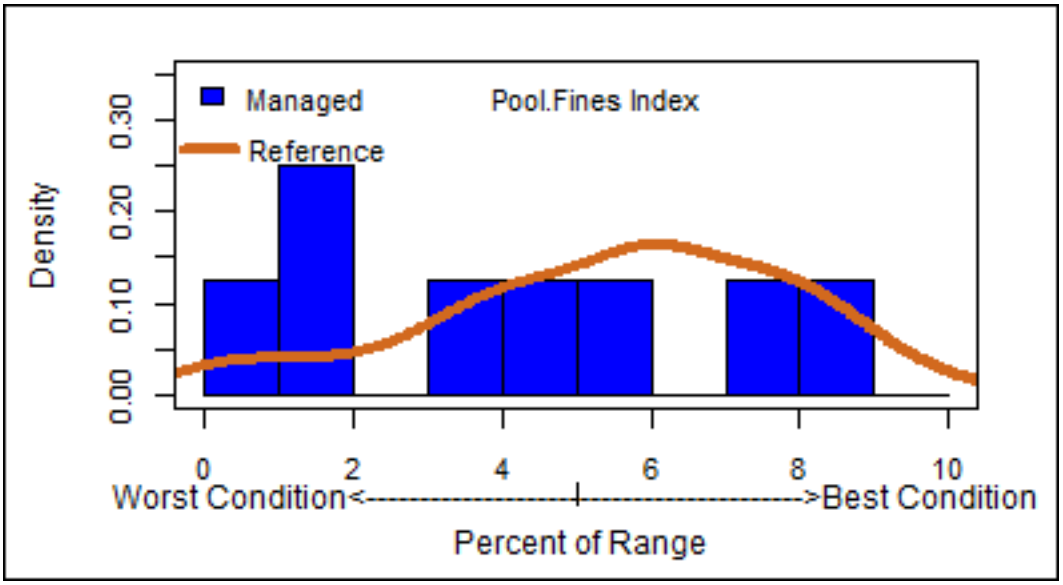

Figure 10. Pool Fines < 6 mm Index values across the Lower Kootenai. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

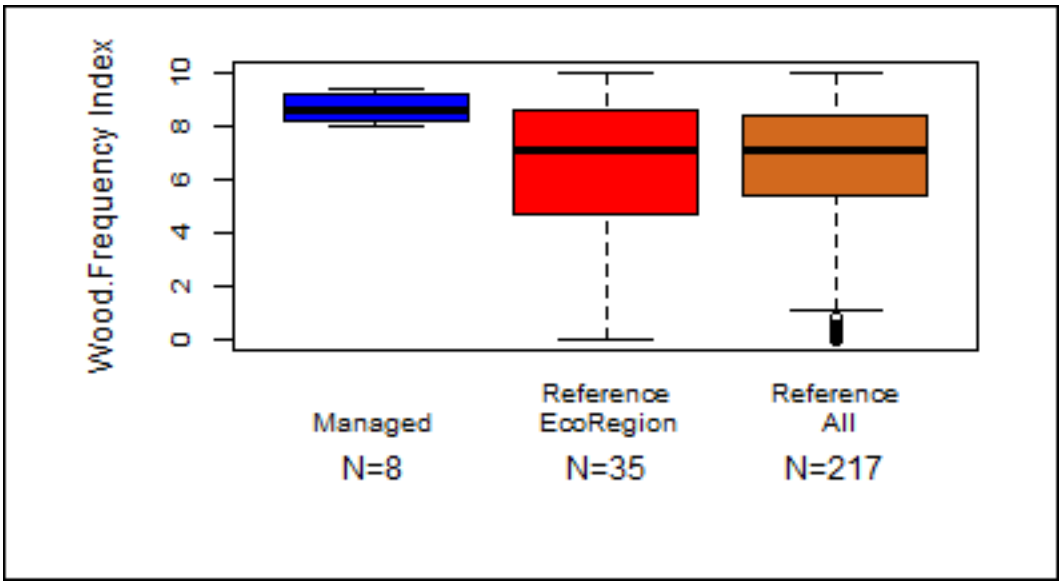

Figure 11. Wood Frequency Index values across the Lower Kootenai. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

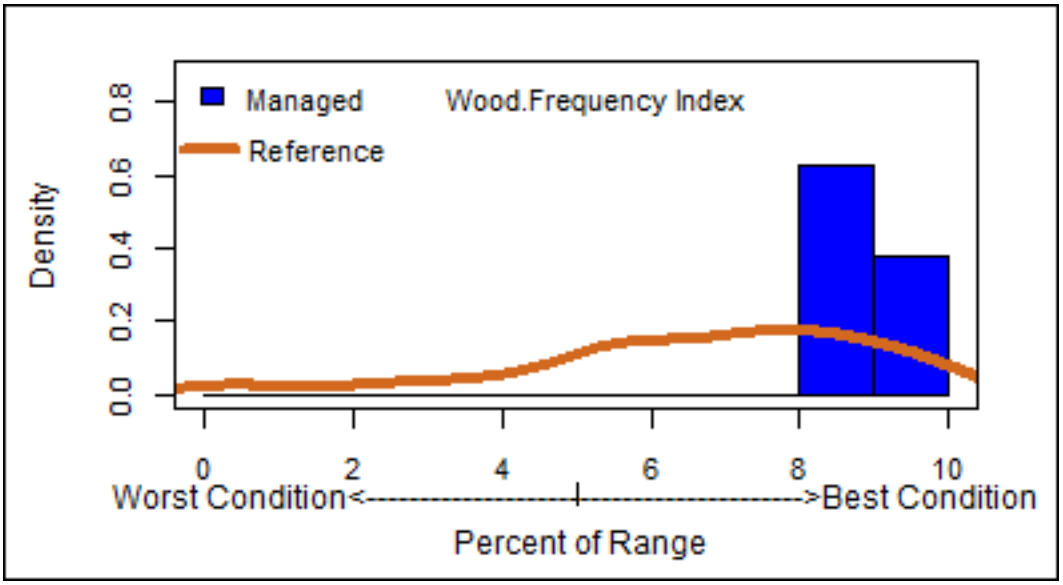

Figure 12. Wood Frequency Index values across the Lower Kootenai. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

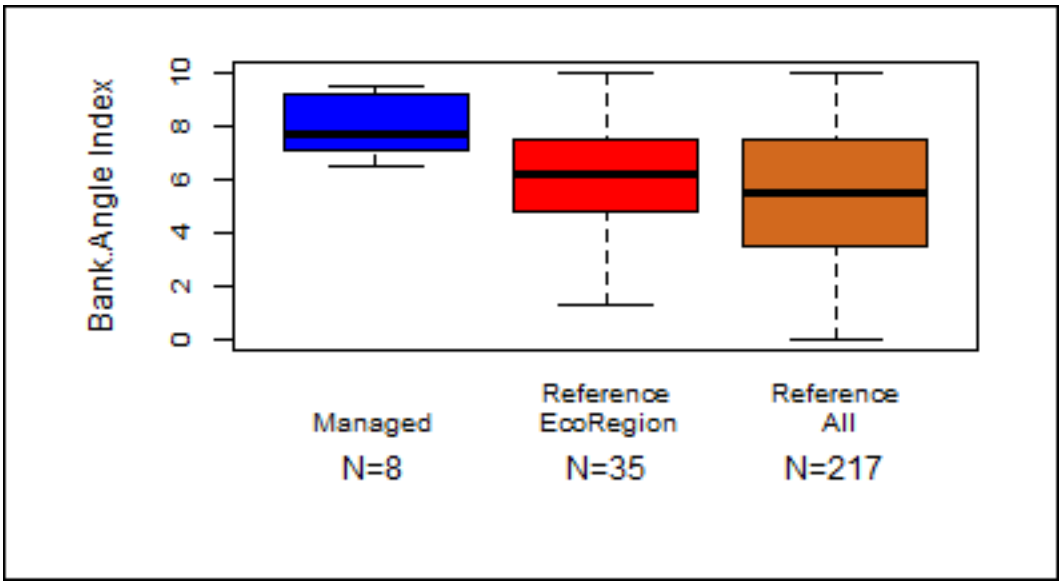

Figure 13. Bank Angle Index values across the Lower Kootenai. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

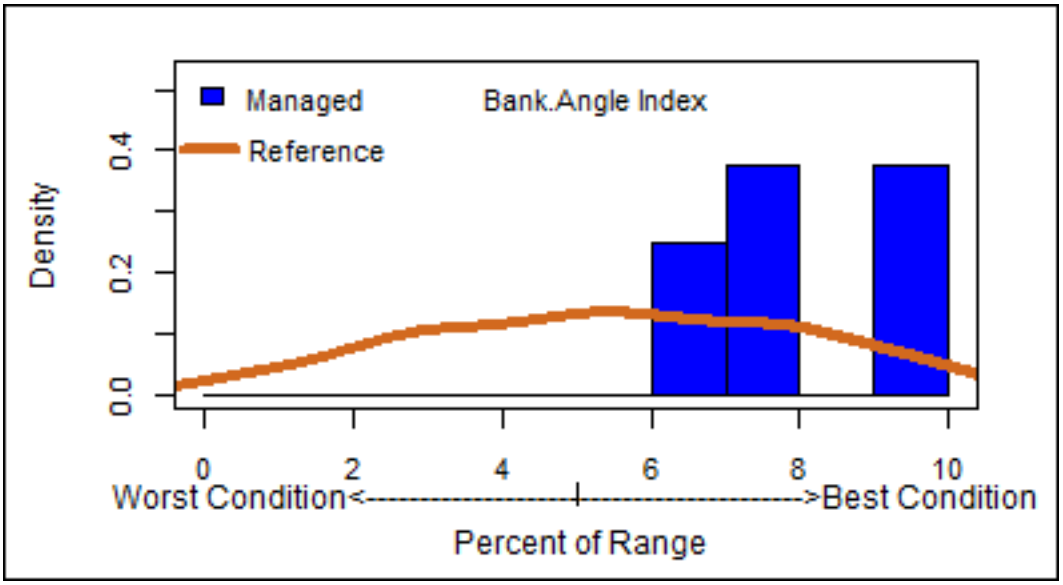

Figure 14. Bank Angle Index values across the Lower Kootenai. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

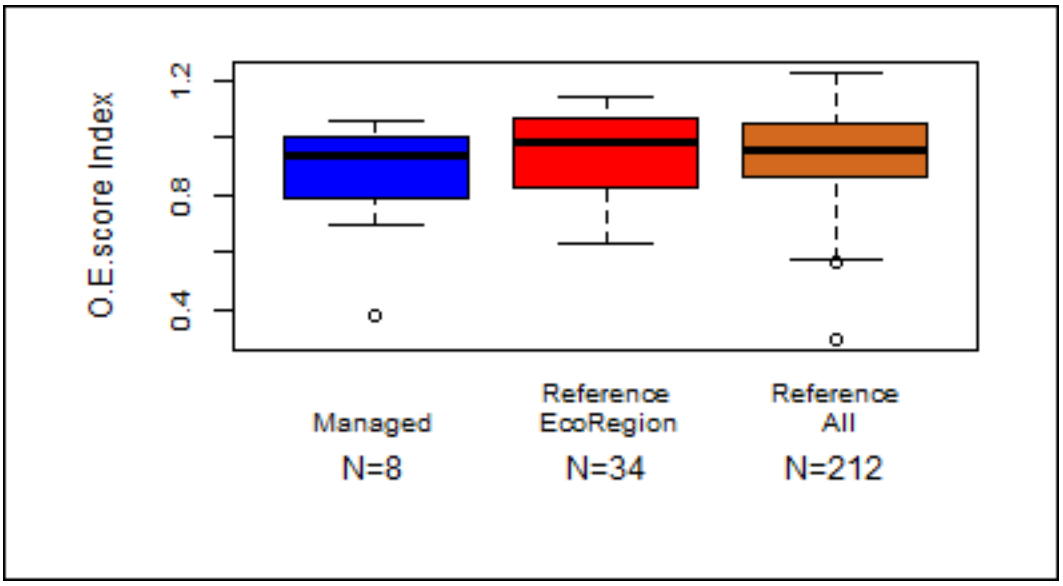

Figure 15. O/E Macroinvertebrate score Index values across the Lower Kootenai. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

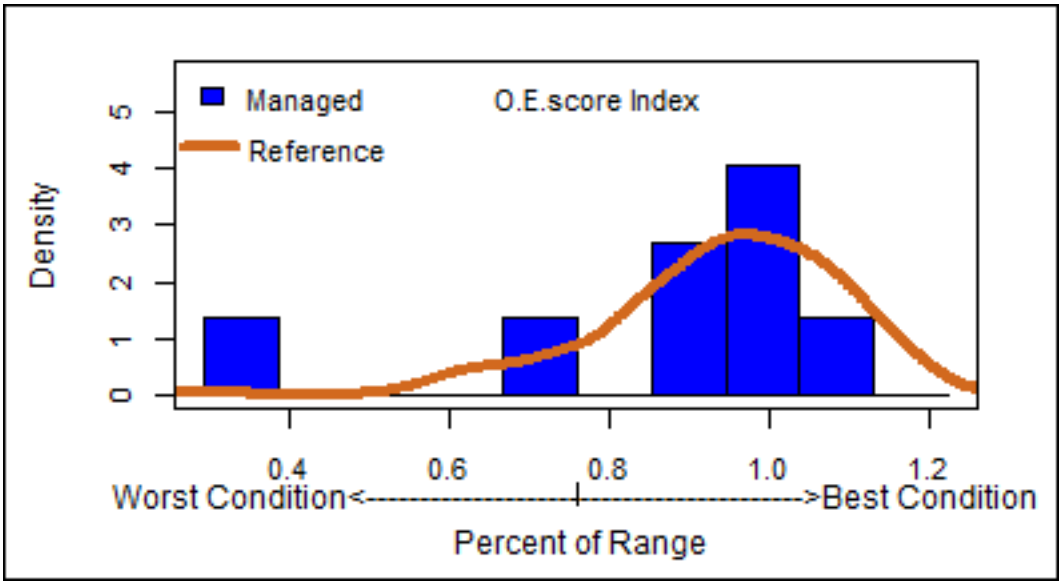

Figure 16. O/E Macroinvertebrate score Index values across the Lower Kootenai. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

Table1. Summary of Index Scores--Lower Kootenai; N=sample size, p-value=significance (0.05), sd=standard deviation, ci=95% confidence interval

InterestArea	Metric	Indexscore	N	pvalue	sd	ci
Managed	Overall	61.97	8	NA	10.34	6.92
Reference Local	Overall	NA	<3	NA	NA	NA
Reference Eco Region	Overall	51.68	34	0.046	18.31	5.32
Reference All	Overall	52.02	216	0.03	16.69	1.88
Managed	Residual.Pool.Depth	6.62	8	NA	2.06	1.38
Reference Local	Residual.Pool.Depth	NA	<3	NA	NA	NA
Reference Eco Region	Residual.Pool.Depth	5.23	35	0.133	2.87	0.82
Reference All	Residual.Pool.Depth	5.41	217	0.145	2.4	0.27
Managed	Pool.Percent	5.33	8	NA	3.22	2.16
Reference Local	Pool.Percent	NA	<3	NA	NA	NA
Reference Eco Region	Pool.Percent	4.81	35	0.68	2.73	0.78
Reference All	Pool.Percent	4.93	217	0.736	2.49	0.28
Managed	Median.Substrate	4.78	8	NA	1.75	1.17
Reference Local	Median.Substrate	NA	<3	NA	NA	NA
Reference Eco Region	Median.Substrate	5.84	35	0.162	2.08	0.59
Reference All	Median.Substrate	5.56	217	0.26	2.51	0.28
Managed	Pool.Fines	4.1	8	NA	2.94	1.97
Reference Local	Pool.Fines	NA	<3	NA	NA	NA
Reference Eco Region	Pool.Fines	5.25	34	0.322	2.01	0.58
Reference All	Pool.Fines	5.49	216	0.227	2.39	0.27
Managed	Wood.Frequency	8.69	8	NA	0.56	0.38
Reference Local	Wood.Frequency	NA	<3	NA	NA	NA
Reference Eco Region	Wood.Frequency	6.09	35	p<0.01	3	0.86
Reference All	Wood.Frequency	6.62	217	p<0.01	2.38	0.27
Managed	Bank.Angle	8.03	8	NA	1.15	0.77
Reference Local	Bank.Angle	NA	<3	NA	NA	NA
Reference Eco Region	Bank.Angle	5.94	35	p<0.01	2.35	0.67
Reference All	Bank.Angle	5.45	217	p<0.01	2.54	0.29
Managed	O.E.score	0.86	8	NA	0.22	0.15
Reference Local	O.E.score	NA	<3	NA	NA	NA
Reference Eco Region	O.E.score	0.95	34	0.315	0.14	0.04
Reference All	O.E.score	0.94	212	0.338	0.15	0.02

Trend

Table 2 .Trend in stream habitat attributes across the Lower Kootenai Subbasin including: Overall_Index score, O.E. (Observed/Expected macroinvertebrate score), VegStab (bank stability), UnCutPct (percent undercut banks), LWFrq (large wood frequency), Bank Angle, PTFines6 (percent fines in pool tails), D50 (median substrate size), RPD (residual pool depth), and PoolPct (percent pools). Refer to page 5 of methods (Heading: 'Summary Tables') for further explanation. Time1 = mean during first visit; Time2 = mean value for last visit; Percent Change = Percent change in the mean values between the first and last visit; Sample size = number of observations with repeat visits; Negative Number = Number of sites where actual measurement was lower on last visit; Positive Number = Number of sites where actual measurement was higher in last visit; None Number = Number of sites where last visit and first visit values were equal; P-value = Significance test; Desired Direction = direction of change in the mean, which can be either + or -; Actual Change = actual direction of change in the mean, which can be not statistically significant (NS), + or -.

Metric	Time1 Value	Time2 Value	Percent Change	Sample Size	Negative Number	Positive Number	No Change Number	P-value	Desired Direction	Actual Change
Overall_Index	61.53	64.29	4.5	7	5	2	0	0.735	+	NS
O.E.	0.84	0.94	12.1	7	3	4	0	0.612	+	NS
VegStab	66.21	50.31	-24	7	4	3	0	0.31	+	NS
UnCutPct	47.1	53.09	12.7	7	2	5	0	0.31	+	NS
LWFrq	683.47	819.83	20	7	3	4	0	0.398	+	NS
BankAngle	93.14	94.86	1.8	7	3	4	0	0.865	-	NS
PTFines6	29.94	21.22	-29.1	7	6	1	0	0.128	-	NS
D50	0.0714	0.0611	-14.4	7	3	4	0	0.498	+	NS
RPD	0.52	0.51	-2.6	7	3	4	0	1	+	NS
PoolPct	56.32	51.81	-8	7	4	3	0	0.31	+	NS

Status

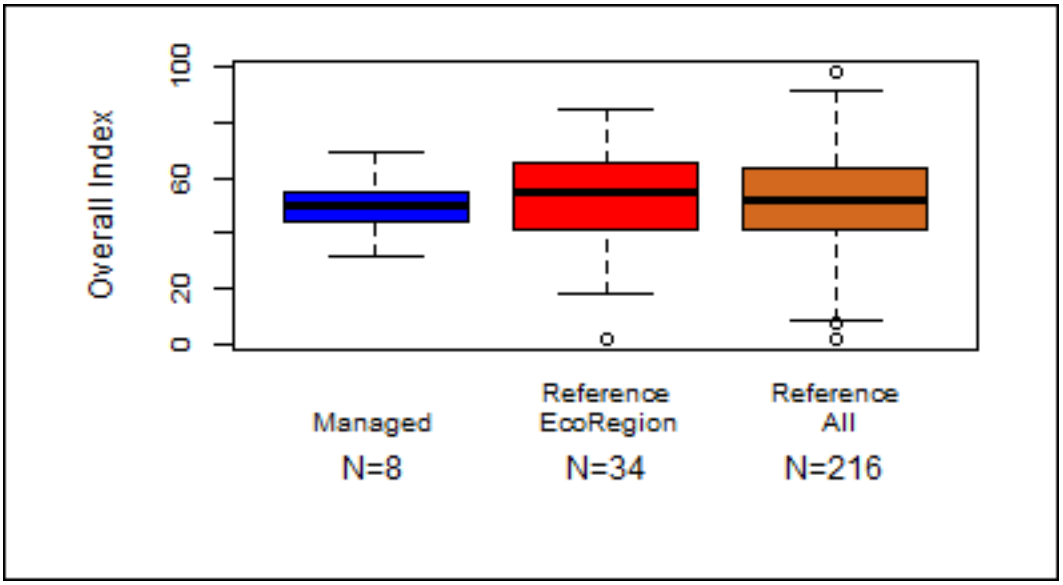

Figure 1. Overall Index values across the Pend Oreille Lake. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

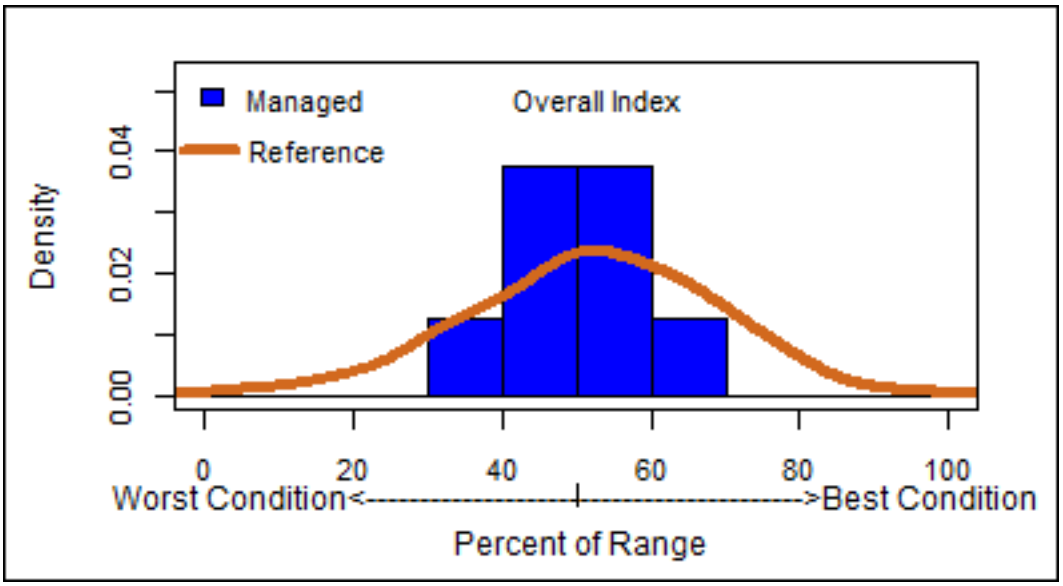

Figure 2. Overall Index values across the Pend Oreille Lake. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

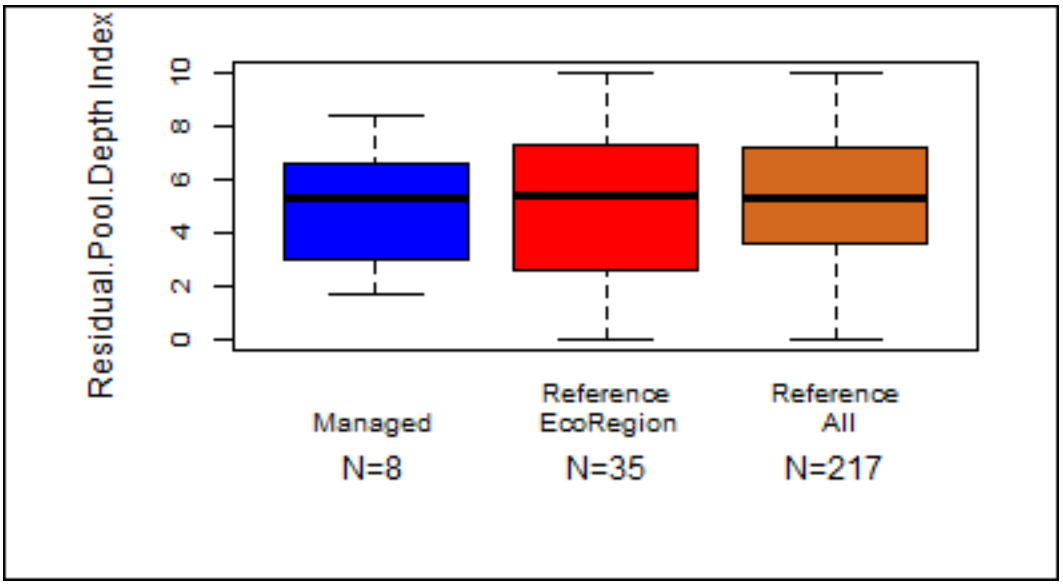

Figure 3. Residual Pool Depth Index values across the Pend Oreille Lake. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

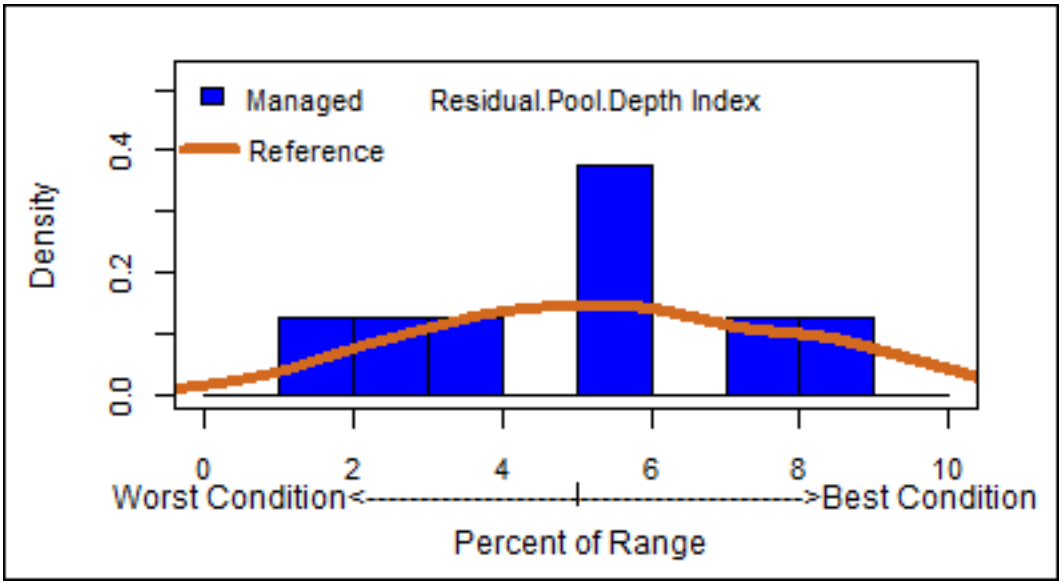

Figure 4. Residual Pool Depth Index values across the Pend Oreille Lake. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

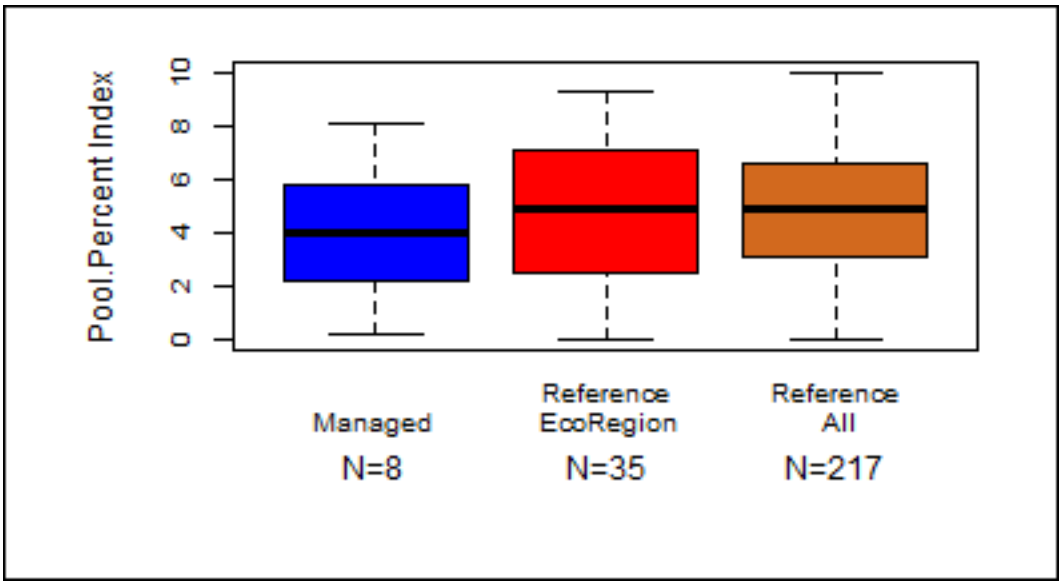

Figure 5. Pool Percent Index values across the Pend Oreille Lake. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

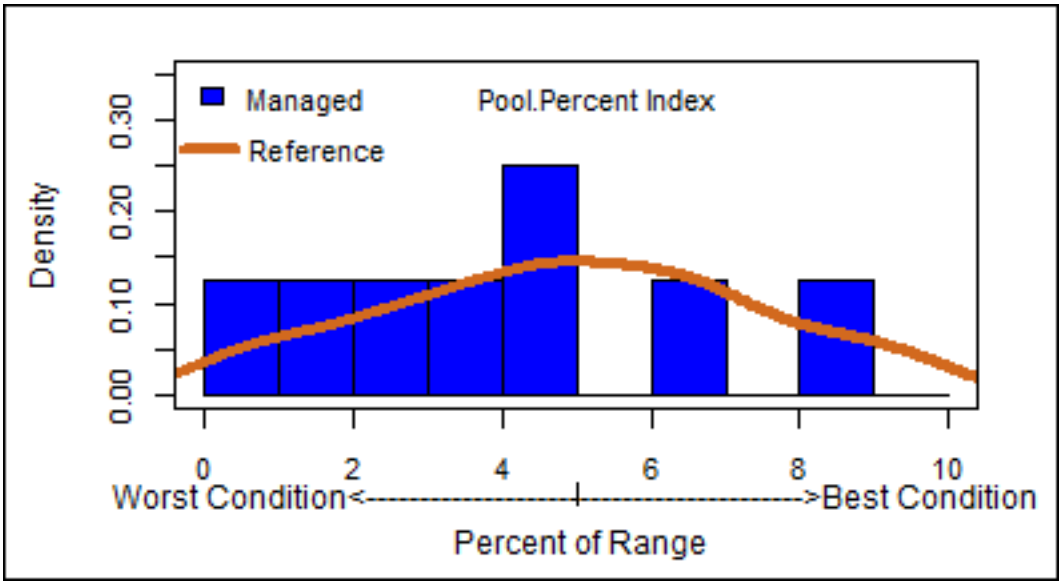

Figure 6. Pool Percent Index values across the Pend Oreille Lake. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

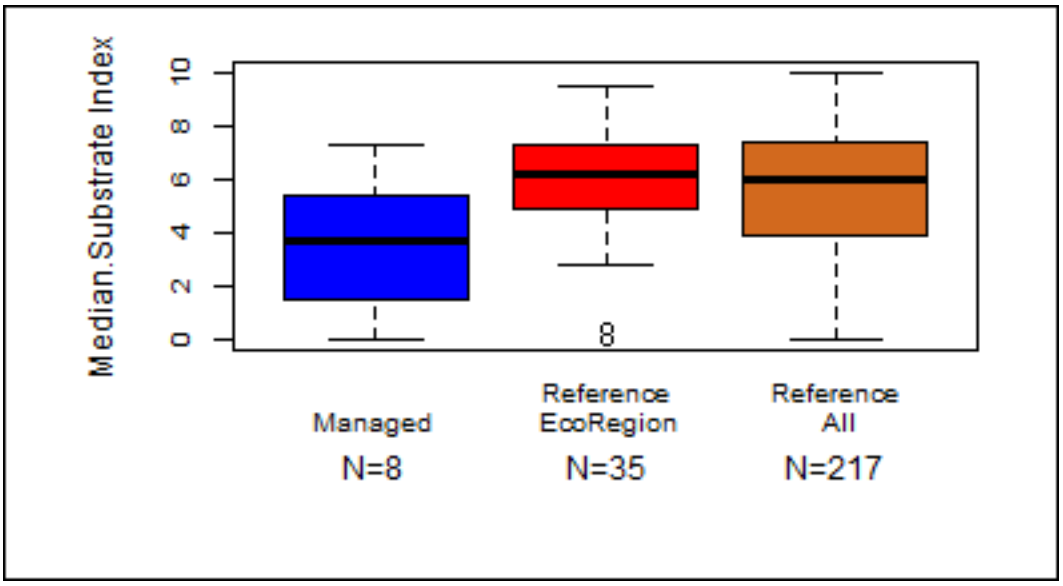

Figure 7. Median substrate Index values across the Pend Oreille Lake. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

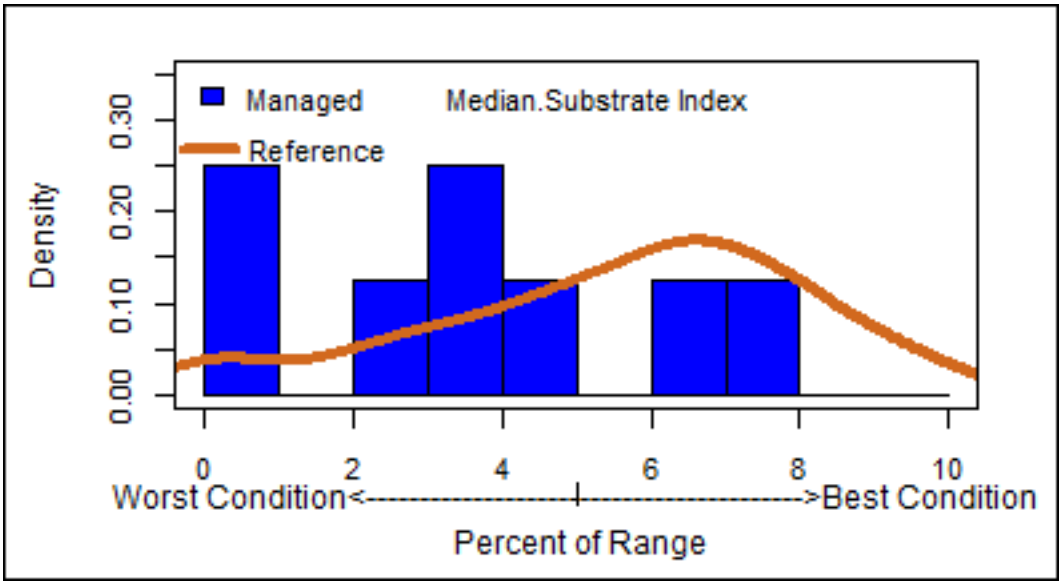

Figure 8. Median substrate Index values across the Pend Oreille Lake. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

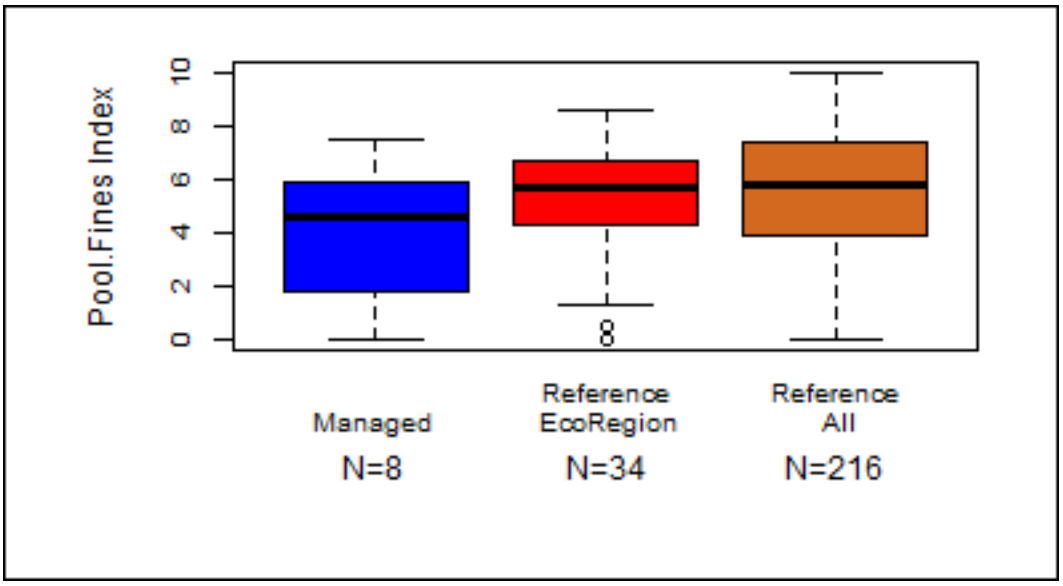

Figure 9. Pool Fines < 6 mm Index values across the Pend Oreille Lake. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

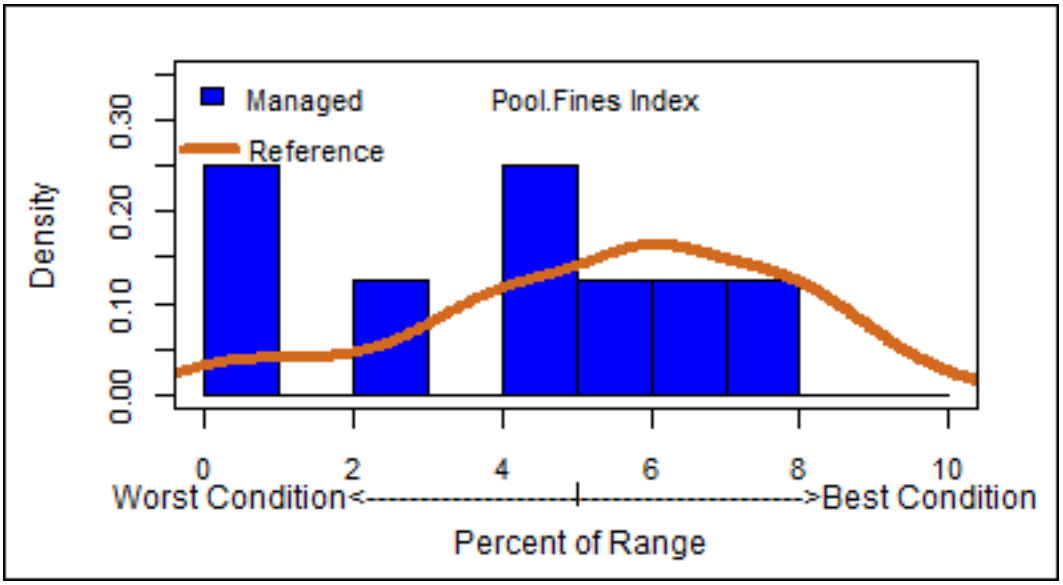

Figure 10. Pool Fines < 6 mm Index values across the Pend Oreille Lake. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

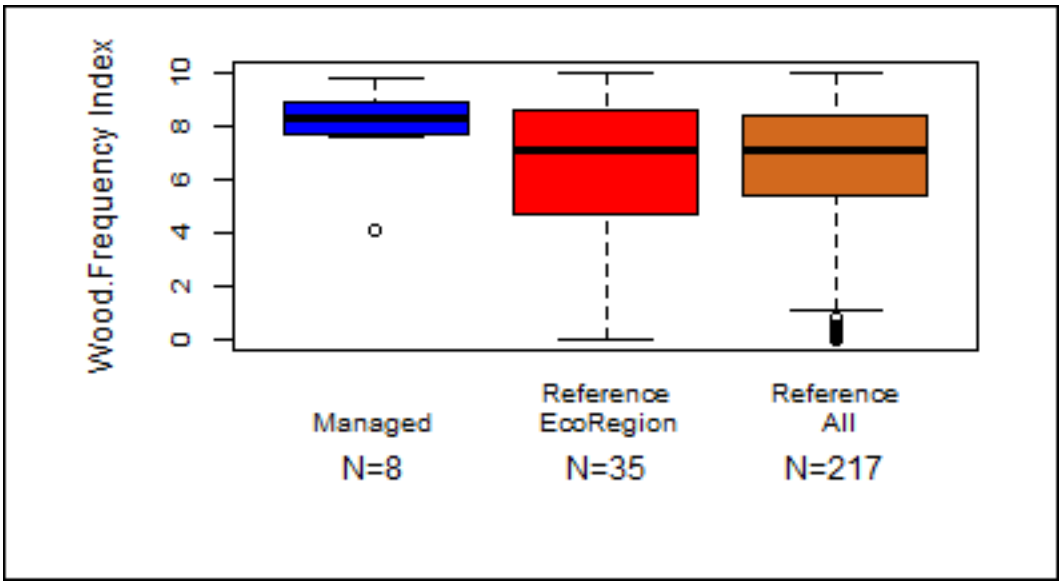

Figure 11. Wood Frequency Index values across the Pend Oreille Lake. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

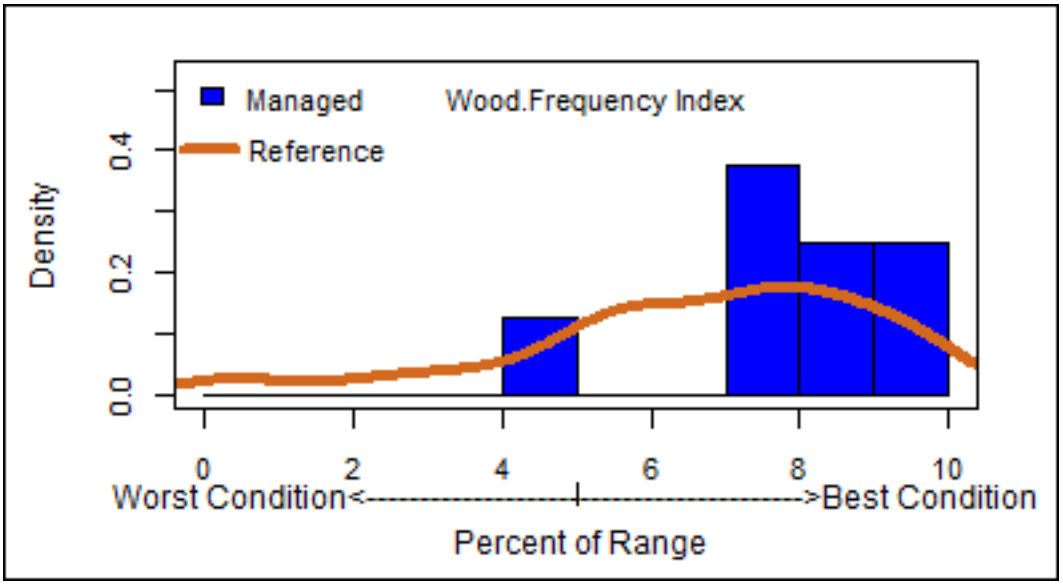

Figure 12. Wood Frequency Index values across the Pend Oreille Lake. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

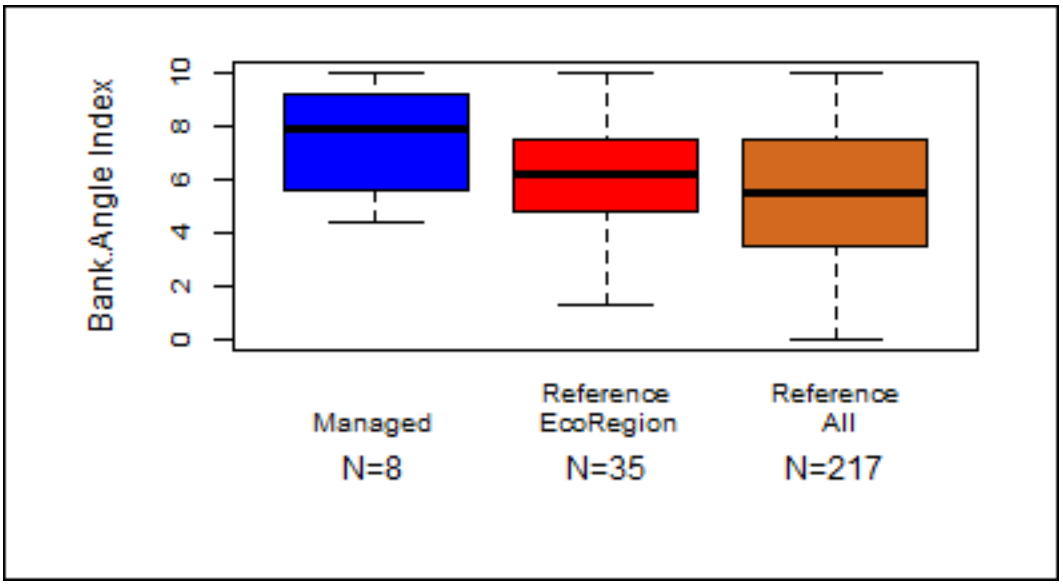

Figure 13. Bank Angle Index values across the Pend Oreille Lake. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

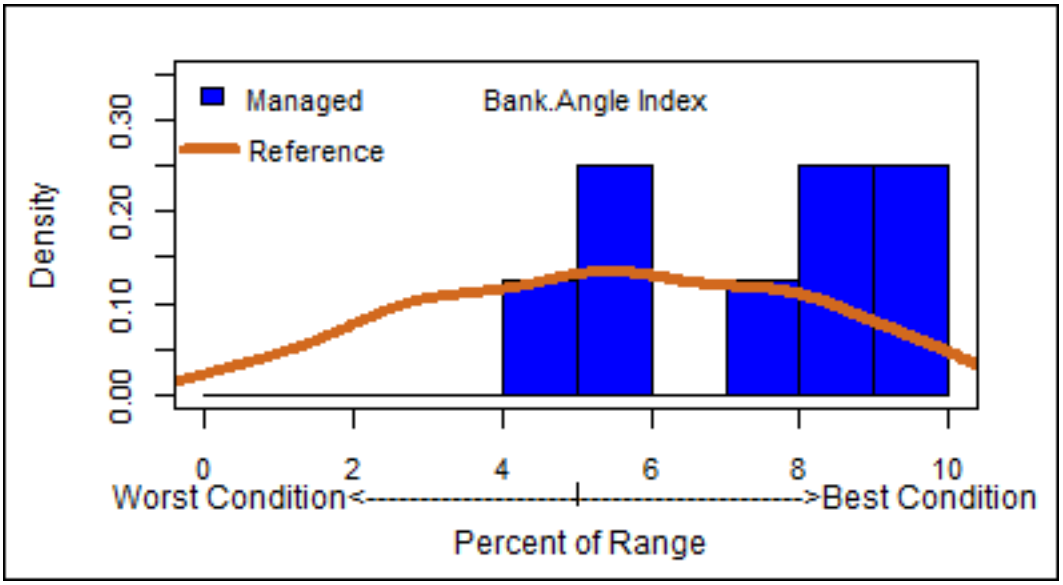

Figure 14. Bank Angle Index values across the Pend Oreille Lake. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

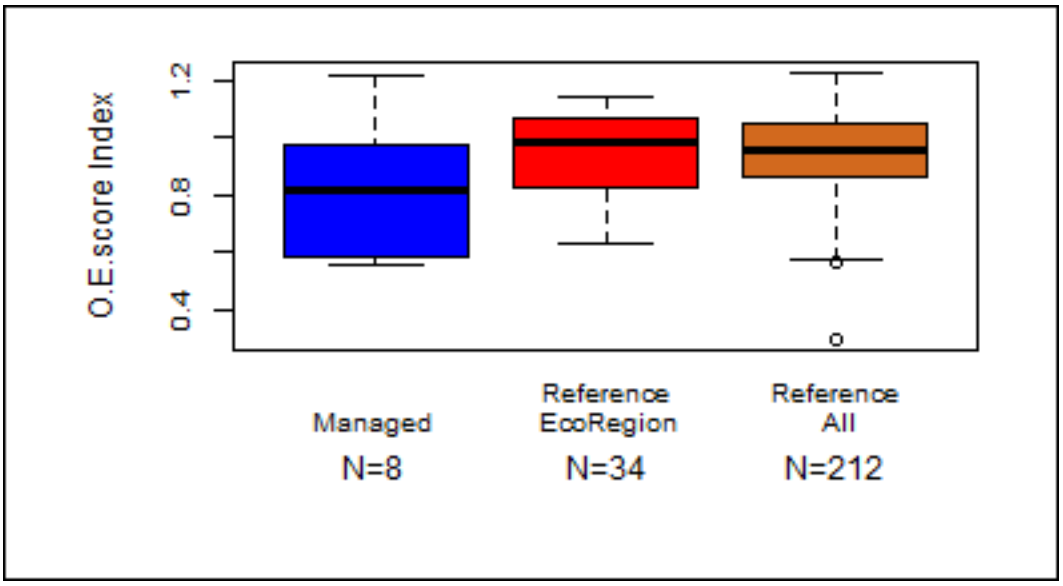

Figure 15. O/E Macroinvertebrate score Index values across the Pend Oreille Lake. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

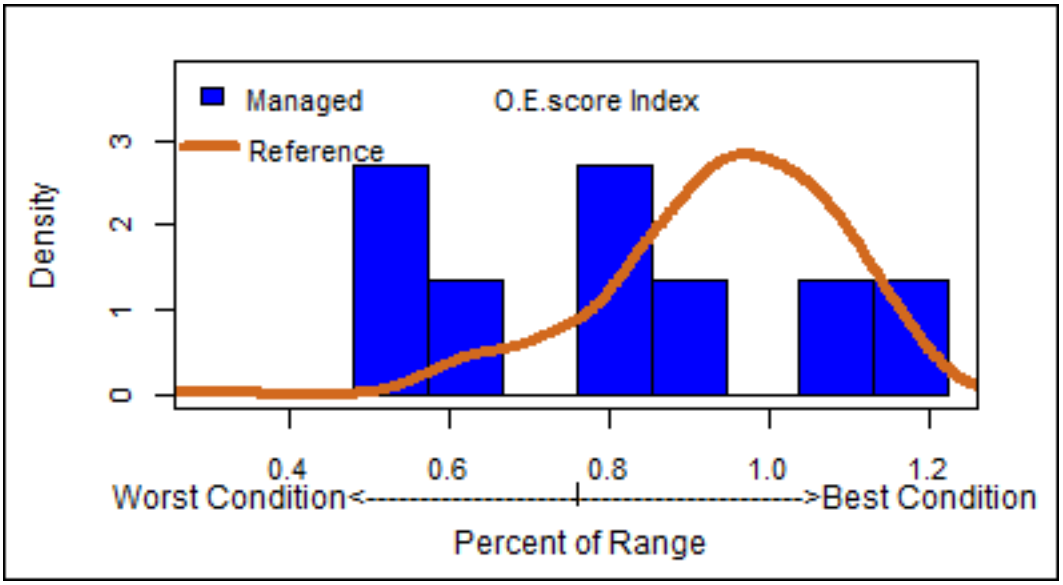

Figure 16. O/E Macroinvertebrate score Index values across the Pend Oreille Lake. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

Table1. Summary of Index Scores--Pend Oreille Lake; N=sample size, p-value=significance (0.05), sd=standard deviation, ci=95% confidence interval

InterestArea	Metric	Indexscore	N	pvalue	sd	ci
Managed	Overall	49.82	8	NA	10.94	7.33
Reference Local	Overall	NA	<3	NA	NA	NA
Reference Eco Region	Overall	51.68	34	0.715	18.31	5.32
Reference All	Overall	52.02	216	0.6	16.69	1.88
Managed	Residual.Pool.Depth	4.97	8	NA	2.32	1.56
Reference Local	Residual.Pool.Depth	NA	<3	NA	NA	NA
Reference Eco Region	Residual.Pool.Depth	5.23	35	0.795	2.87	0.82
Reference All	Residual.Pool.Depth	5.41	217	0.613	2.4	0.27
Managed	Pool.Percent	4.07	8	NA	2.62	1.76
Reference Local	Pool.Percent	NA	<3	NA	NA	NA
Reference Eco Region	Pool.Percent	4.81	35	0.486	2.73	0.78
Reference All	Pool.Percent	4.93	217	0.387	2.49	0.28
Managed	Median.Substrate	3.57	8	NA	2.63	1.76
Reference Local	Median.Substrate	NA	<3	NA	NA	NA
Reference Eco Region	Median.Substrate	5.84	35	0.048	2.08	0.59
Reference All	Median.Substrate	5.56	217	0.071	2.51	0.28
Managed	Pool.Fines	4.03	8	NA	2.68	1.8
Reference Local	Pool.Fines	NA	<3	NA	NA	NA
Reference Eco Region	Pool.Fines	5.25	34	0.256	2.01	0.58
Reference All	Pool.Fines	5.49	216	0.17	2.39	0.27
Managed	Wood.Frequency	7.96	8	NA	1.73	1.16
Reference Local	Wood.Frequency	NA	<3	NA	NA	NA
Reference Eco Region	Wood.Frequency	6.09	35	0.03	3	0.86
Reference All	Wood.Frequency	6.62	217	0.067	2.38	0.27
Managed	Bank.Angle	7.47	8	NA	2.05	1.37
Reference Local	Bank.Angle	NA	<3	NA	NA	NA
Reference Eco Region	Bank.Angle	5.94	35	0.09	2.35	0.67
Reference All	Bank.Angle	5.45	217	0.027	2.54	0.29
Managed	O.E.score	0.82	8	NA	0.24	0.16
Reference Local	O.E.score	NA	<3	NA	NA	NA
Reference Eco Region	O.E.score	0.95	34	0.17	0.14	0.04
Reference All	O.E.score	0.94	212	0.183	0.15	0.02

Trend

Table 2 .Trend in stream habitat attributes across the Pend Oreille Lake Subbasin including: Overall_Index score, O.E. (Observed/Expected macroinvertebrate score), VegStab (bank stability), UnCutPct (percent undercut banks), LWFrq (large wood frequency), Bank Angle, PTFines6 (percent fines in pool tails), D50 (median substrate size), RPD (residual pool depth), and PoolPct (percent pools). Refer to page 5 of methods (Heading: 'Summary Tables') for further explanation. Time1 = mean during first visit; Time2 = mean value for last visit; Percent Change = Percent change in the mean values between the first and last visit; Sample size = number of observations with repeat visits; Negative Number = Number of sites where actual measurement was lower on last visit; Positive Number = Number of sites where actual measurement was higher in last visit; None Number = Number of sites where last visit and first visit values were equal; P-value = Significance test; Desired Direction = direction of change in the mean, which can be either + or -; Actual Change = actual direction of change in the mean, which can be not statistically significant (NS), + or -.

Metric	Time1 Value	Time2 Value	Percent Change	Sample Size	Negative Number	Positive Number	No Change Number	P-value	Desired Direction	Actual Change
Overall_Index	51.24	51.14	-0.2	8	5	3	0	0.889	+	NS
O.E.	0.7	0.89	26.5	8	2	6	0	0.263	+	NS
VegStab	73.29	83.54	14	8	3	5	0	0.263	+	NS
UnCutPct	42.66	39.67	-7	8	4	4	0	1	+	NS
LWFrq	325.59	488.44	50	8	3	5	0	0.123	+	NS
BankAngle	99.75	100.75	1	8	4	4	0	0.889	-	NS
PTFines6	25.34	23.81	-6	8	5	3	0	0.674	-	NS
D50	0.0351	0.052	48.3	8	2	5	1	0.128	+	NS
RPD	0.32	0.3	-7.5	8	4	4	0	0.484	+	NS
PoolPct	40.99	39.22	-4.3	8	3	5	0	1	+	NS

Status

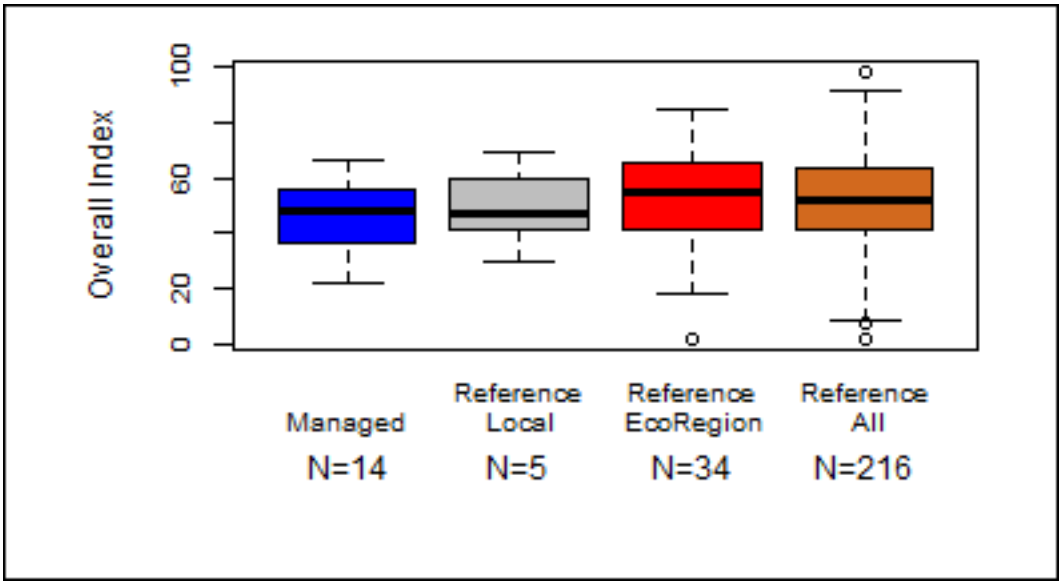

Figure 1. Overall Index values across the Upper Coeur d'Alene. Median and range of index values for managed sites, reference sites within the area of evaluation, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

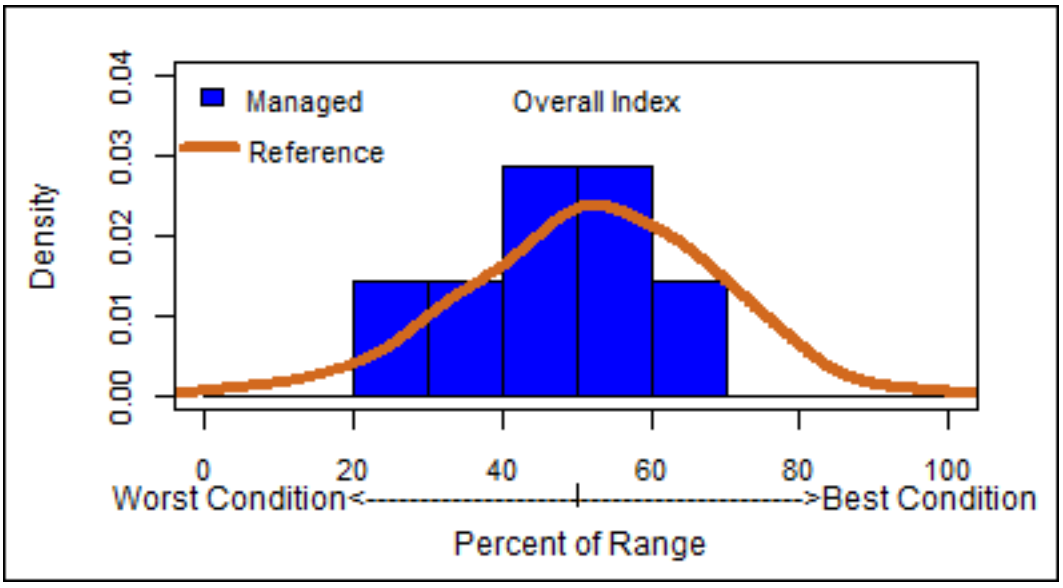

Figure 2. Overall Index values across the Upper Coeur d'Alene. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

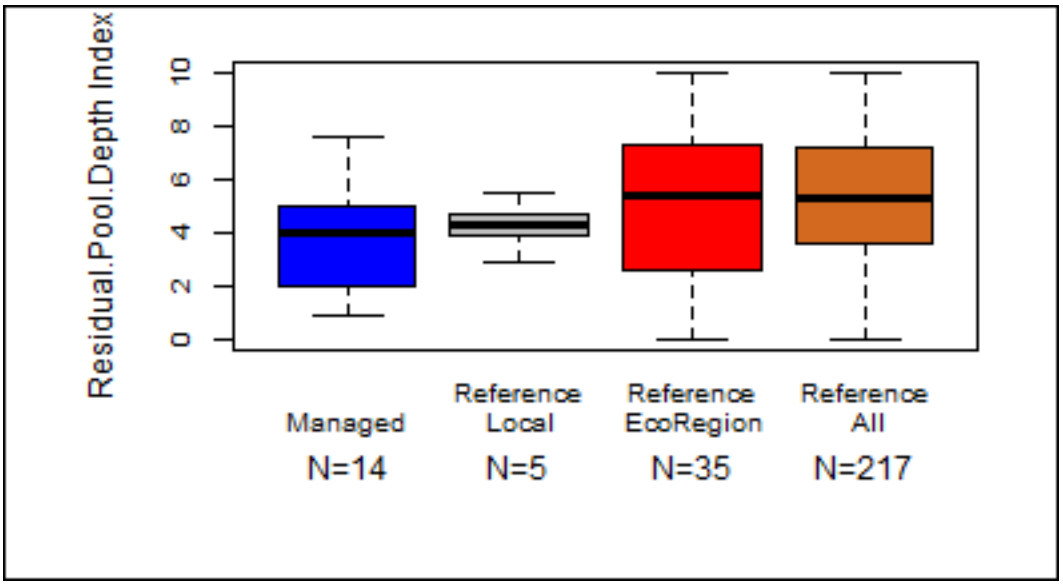

Figure 3. Residual Pool Depth Index values across the Upper Coeur d'Alene. Median and range of index values for managed sites, reference sites within the area of evaluation, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

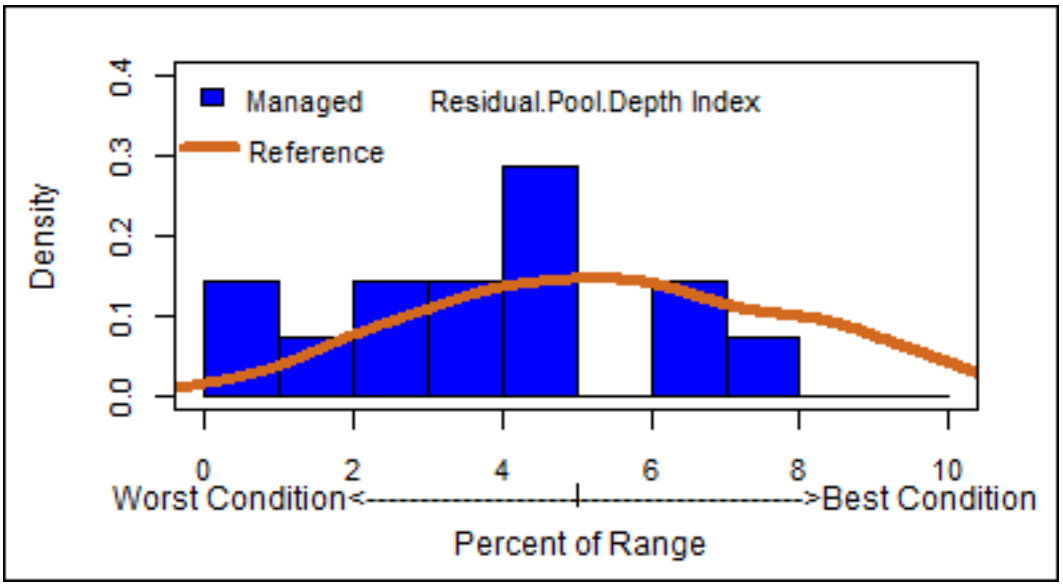

Figure 4. Residual Pool Depth Index values across the Upper Coeur d'Alene. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

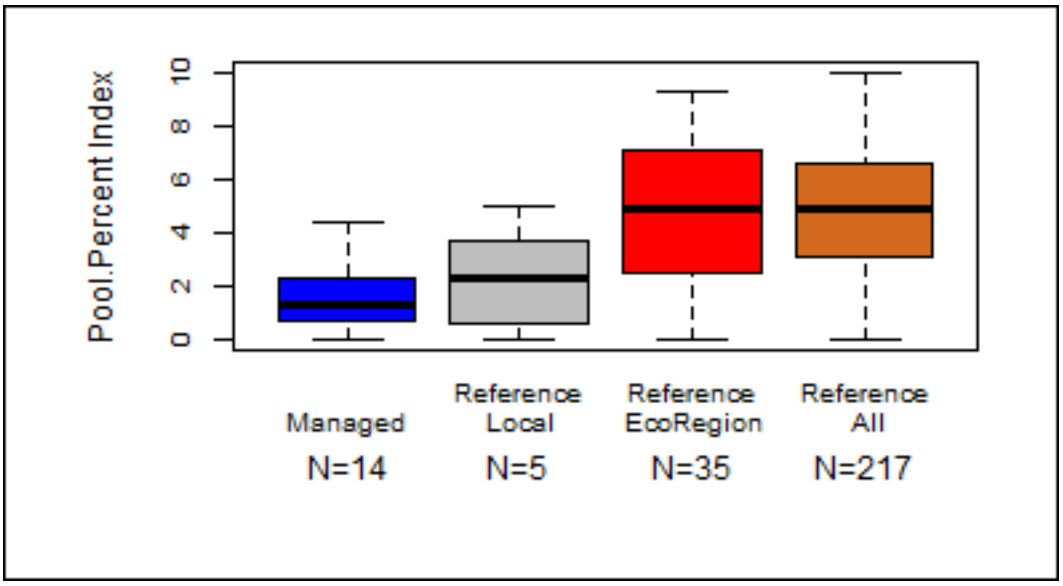

Figure 5. Pool Percent Index values across the Upper Coeur d'Alene. Median and range of index values for managed sites, reference sites within the area of evaluation, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

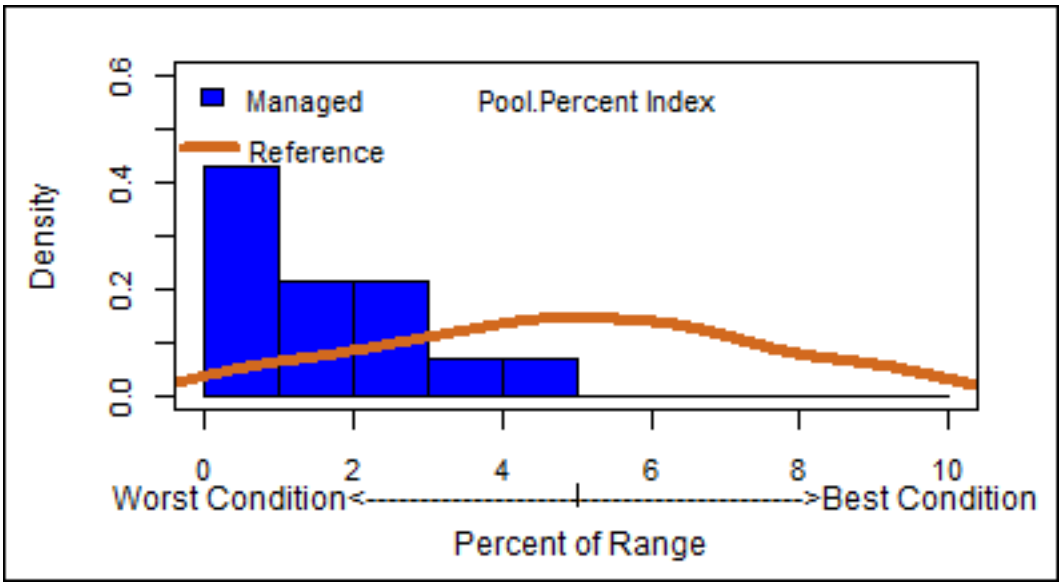

Figure 6. Pool Percent Index values across the Upper Coeur d'Alene. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

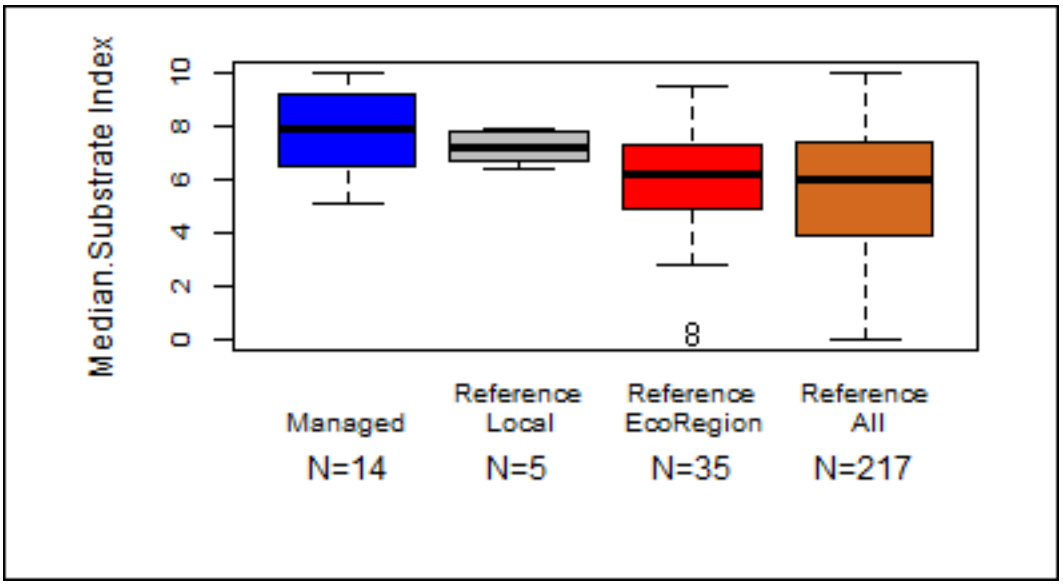

Figure 7. Median substrate Index values across the Upper Coeur d'Alene. Median and range of index values for managed sites, reference sites within the area of evaluation, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

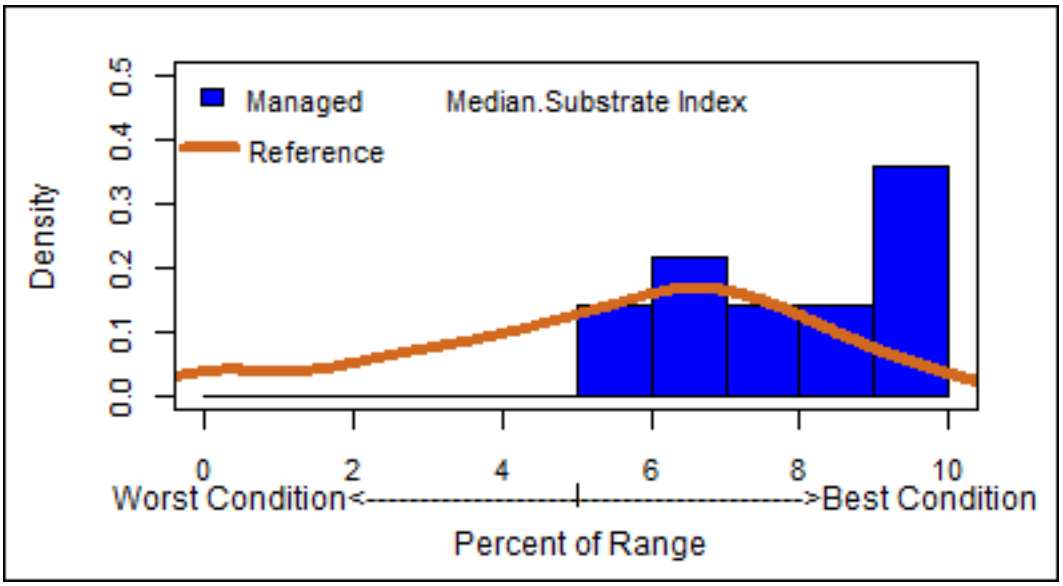

Figure 8. Median substrate Index values across the Upper Coeur d'Alene. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

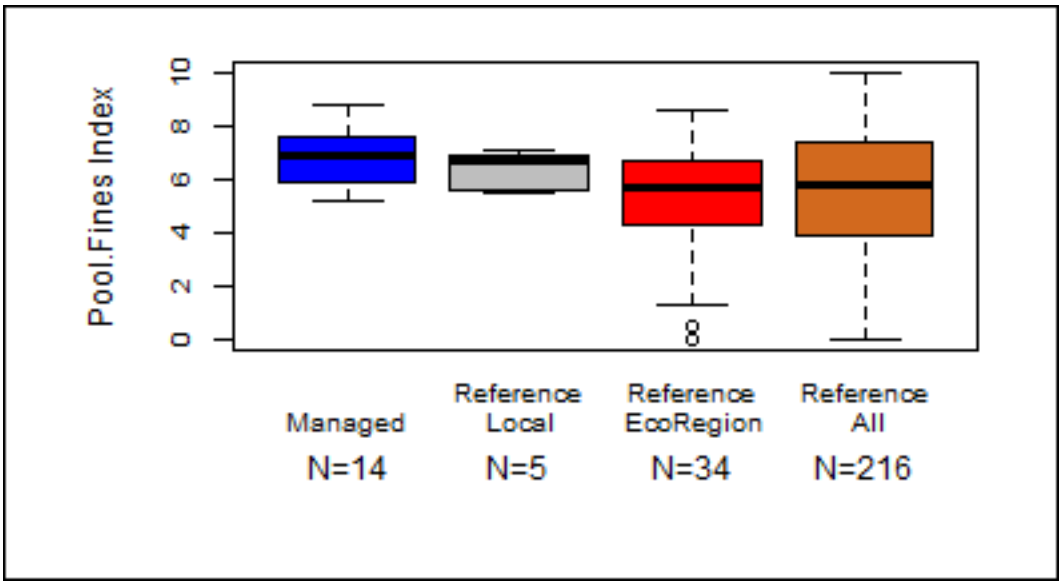

Figure 9. Pool Fines < 6 mm Index values across the Upper Coeur d'Alene. Median and range of index values for managed sites, reference sites within the area of evaluation, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

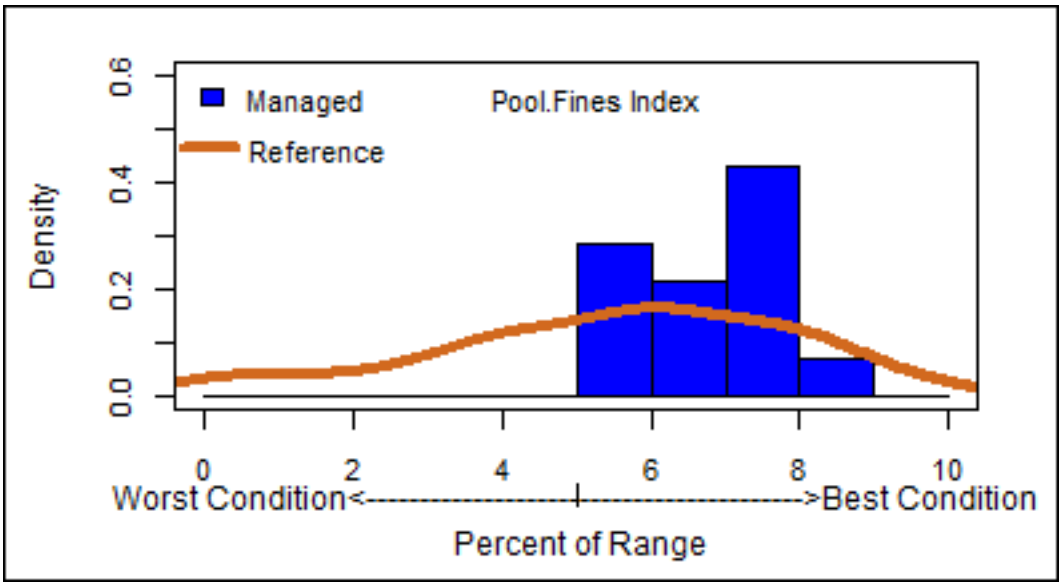

Figure 10. Pool Fines < 6 mm Index values across the Upper Coeur d'Alene. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

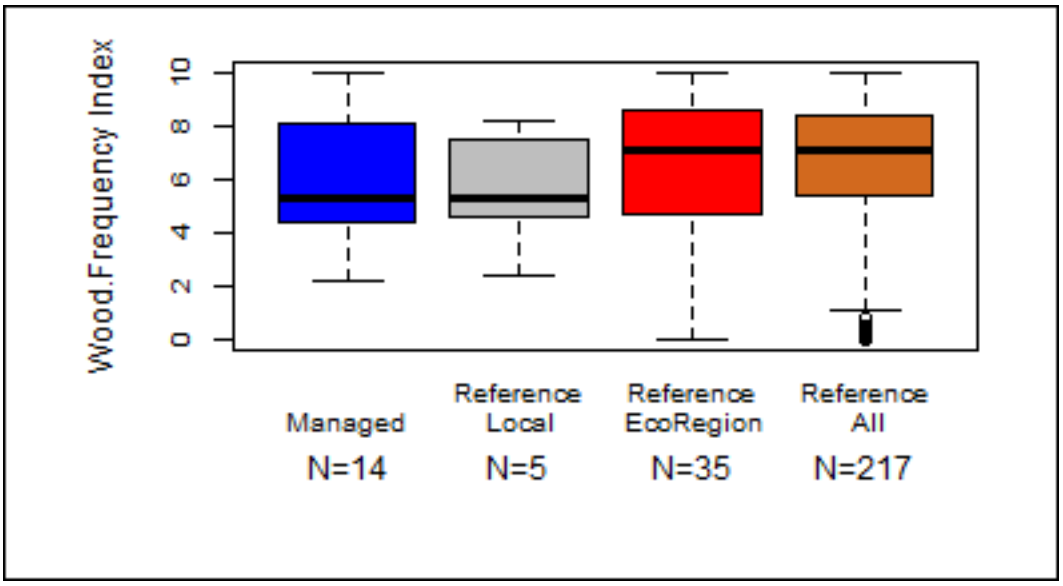

Figure 11. Wood Frequency Index values across the Upper Coeur d'Alene. Median and range of index values for managed sites, reference sites within the area of evaluation, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

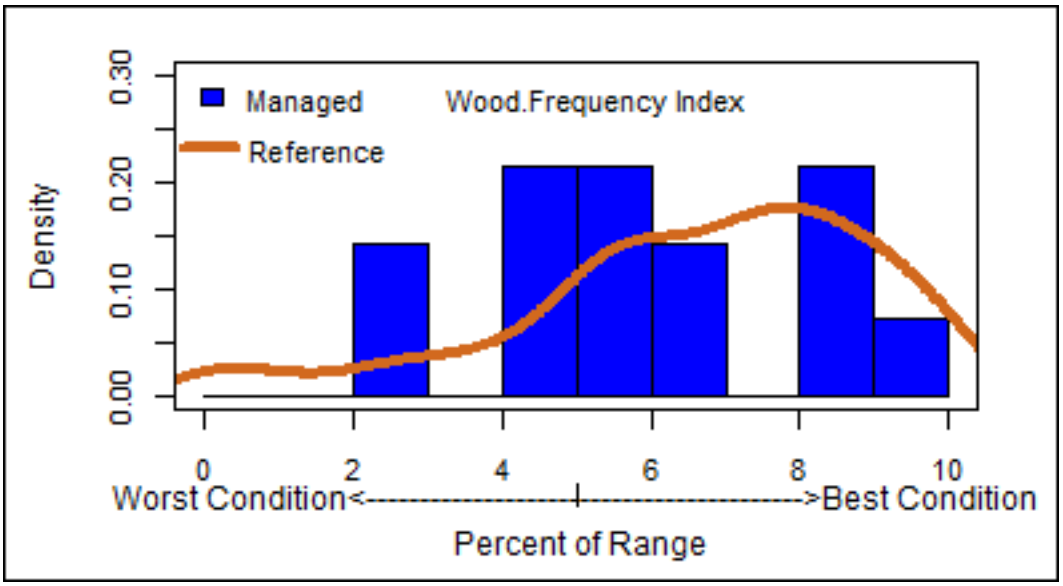

Figure 12. Wood Frequency Index values across the Upper Coeur d'Alene. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

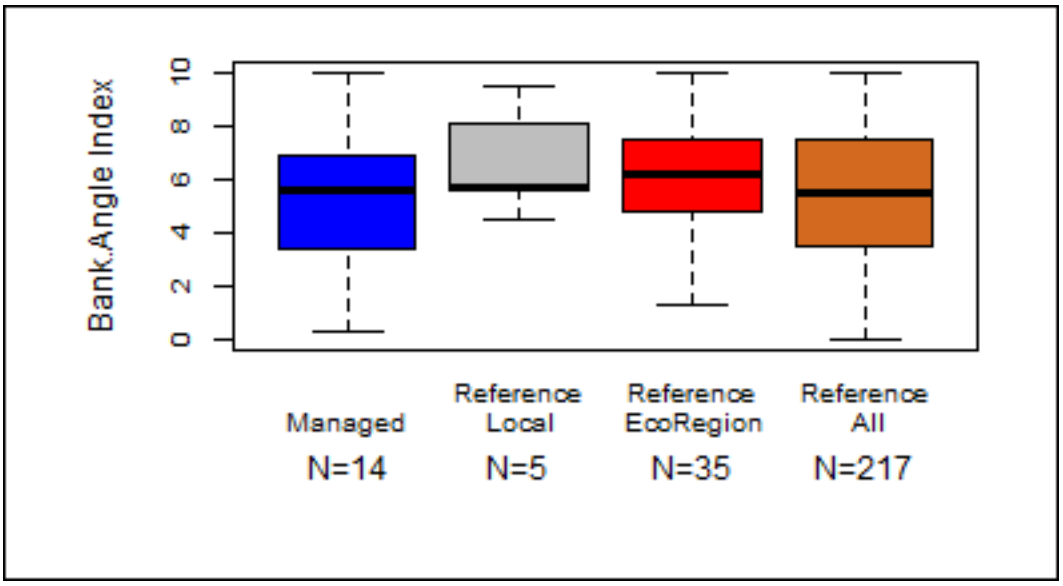

Figure 13. Bank Angle Index values across the Upper Coeur d'Alene. Median and range of index values for managed sites, reference sites within the area of evaluation, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

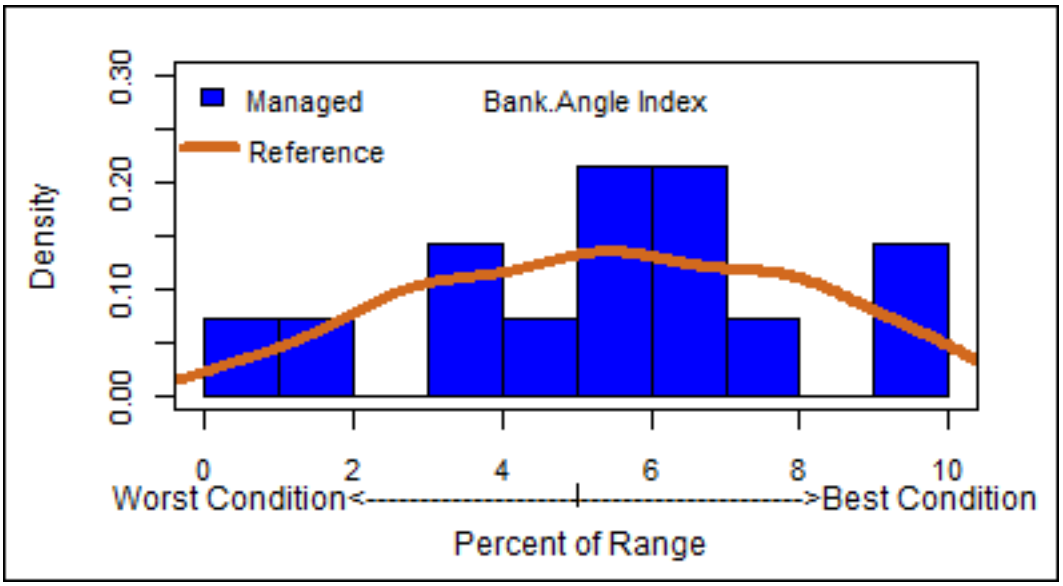

Figure 14. Bank Angle Index values across the Upper Coeur d'Alene. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

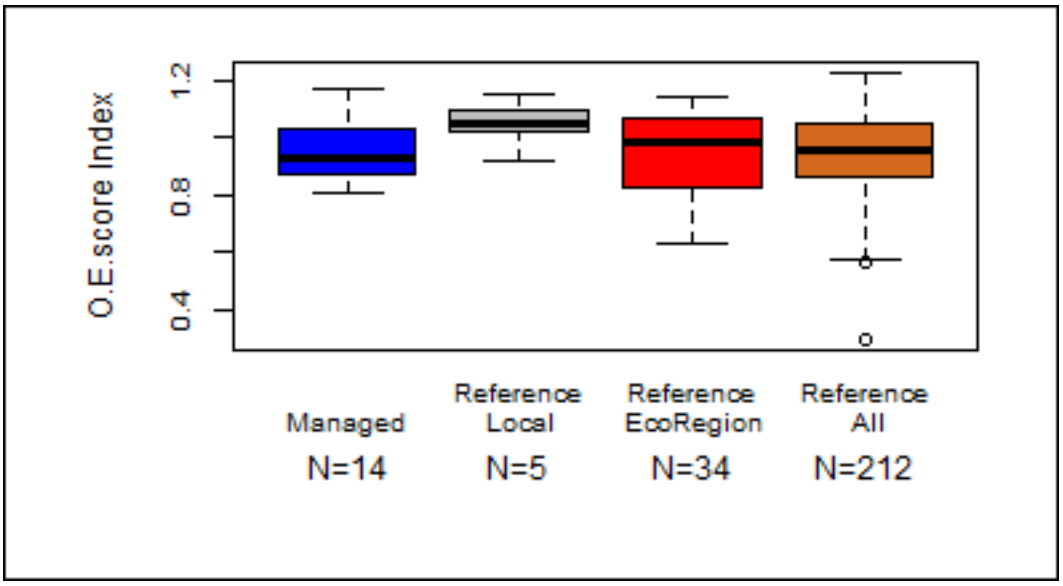

Figure 15. O/E Macroinvertebrate score Index values across the Upper Coeur d'Alene. Median and range of index values for managed sites, reference sites within the area of evaluation, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

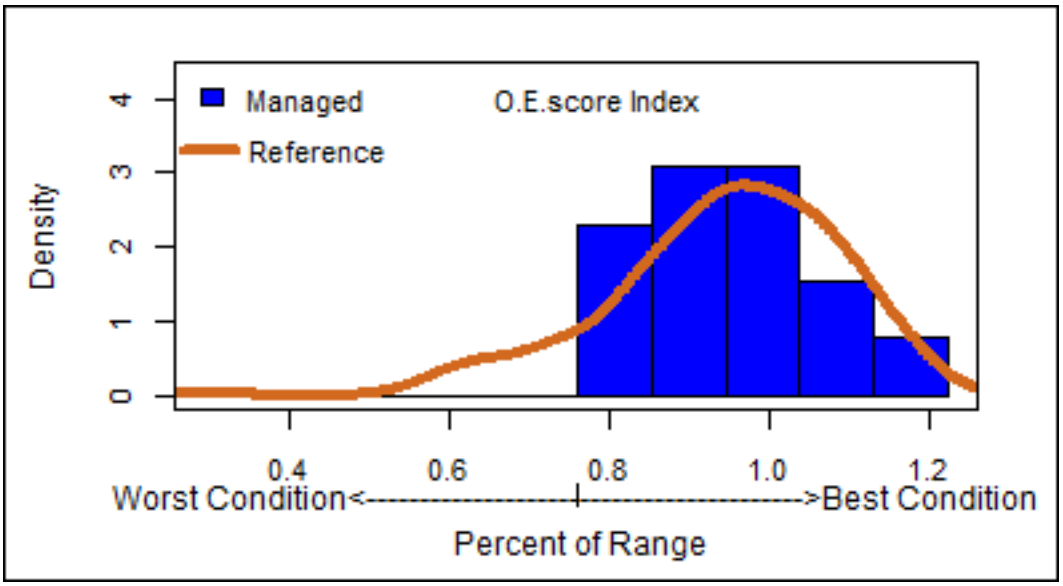

Figure 16. O/E Macroinvertebrate score Index values across the Upper Coeur d'Alene. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

Table1. Summary of Index Scores--Upper Coeur d'Alene; N=sample size, p-value=significance (0.05), sd=standard deviation, ci=95% confidence interval

InterestArea	Metric	Indexscore	N	pvalue	sd	ci
Managed	Overall	46.77	14	NA	12.99	6.15
Reference Local	Overall	49.25	5	0.758	15.33	14.62
Reference Eco Region	Overall	51.68	34	0.302	18.31	5.32
Reference All	Overall	52.02	216	0.17	16.69	1.88
Managed	Residual.Pool.Depth	3.84	14	NA	2.1	0.99
Reference Local	Residual.Pool.Depth	4.27	5	0.553	0.97	0.92
Reference Eco Region	Residual.Pool.Depth	5.23	35	0.071	2.87	0.82
Reference All	Residual.Pool.Depth	5.41	217	0.016	2.4	0.27
Managed	Pool.Percent	1.62	14	NA	1.25	0.59
Reference Local	Pool.Percent	2.34	5	0.498	2.09	1.99
Reference Eco Region	Pool.Percent	4.81	35	p<0.01	2.73	0.78
Reference All	Pool.Percent	4.93	217	p<0.01	2.49	0.28
Managed	Median.Substrate	7.86	14	NA	1.58	0.75
Reference Local	Median.Substrate	7.19	5	0.214	0.67	0.63
Reference Eco Region	Median.Substrate	5.84	35	p<0.01	2.08	0.59
Reference All	Median.Substrate	5.56	217	p<0.01	2.51	0.28
Managed	Pool.Fines	6.9	14	NA	0.99	0.47
Reference Local	Pool.Fines	6.37	5	0.248	0.76	0.72
Reference Eco Region	Pool.Fines	5.25	34	p<0.01	2.01	0.58
Reference All	Pool.Fines	5.49	216	p<0.01	2.39	0.27
Managed	Wood.Frequency	5.85	14	NA	2.31	1.09
Reference Local	Wood.Frequency	5.62	5	0.854	2.32	2.21
Reference Eco Region	Wood.Frequency	6.09	35	0.772	3	0.86
Reference All	Wood.Frequency	6.62	217	0.249	2.38	0.27
Managed	Bank.Angle	5.25	14	NA	2.75	1.3
Reference Local	Bank.Angle	6.69	5	0.252	2.05	1.95
Reference Eco Region	Bank.Angle	5.94	35	0.42	2.35	0.67
Reference All	Bank.Angle	5.45	217	0.795	2.54	0.29
Managed	O.E.score	0.95	14	NA	0.11	0.05
Reference Local	O.E.score	1.05	5	0.077	0.09	0.08
Reference Eco Region	O.E.score	0.95	34	0.963	0.14	0.04
Reference All	O.E.score	0.94	212	0.875	0.15	0.02

Trend

Table 2 .Trend in stream habitat attributes across the Upper Coeur d'Alene Subbasin including: Overall_Index score, O.E. (Observed/Expected macroinvertebrate score), VegStab (bank stability), UnCutPct (percent undercut banks), LWFrq (large wood frequency), Bank Angle, PTFines6 (percent fines in pool tails), D50 (median substrate size), RPD (residual pool depth), and PoolPct (percent pools). Refer to page 5 of methods (Heading: 'Summary Tables') for further explanation. Time1 = mean during first visit; Time2 = mean value for last visit; Percent Change = Percent change in the mean values between the first and last visit; Sample size = number of observations with repeat visits; Negative Number = Number of sites where actual measurement was lower on last visit; Positive Number = Number of sites where actual measurement was higher in last visit; None Number = Number of sites where last visit and first visit values were equal; P-value = Significance test; Desired Direction = direction of change in the mean, which can be either + or -; Actual Change = actual direction of change in the mean, which can be not statistically significant (NS), + or -.

Metric	Time1 Value	Time2 Value	Percent Change	Sample Size	Negative Number	Positive Number	No Change Number	P-value	Desired Direction	Actual Change
Overall_Index	37.77	49.5	31.1	12	4	8	0	0.071	+	+
O.E.	0.96	0.93	-2.6	13	8	5	0	0.507	+	NS
VegStab	70.04	84.99	21.4	13	2	11	0	0.028	+	+
UnCutPct	23.08	28.93	25.3	13	6	7	0	0.311	+	NS
LWFrq	122.84	171.6	39.7	13	3	10	0	0.006	+	+
BankAngle	119.38	114	-4.5	13	7	3	3	0.153	-	NS
PTFines6	17.44	8.31	-52.4	12	6	6	0	0.308	-	NS
D50	0.059	0.0625	6	13	4	8	1	0.53	+	NS
RPD	0.3	0.31	2.5	13	4	9	0	0.249	+	NS
PoolPct	32.5	26.49	-18.5	13	7	6	0	0.249	+	NS

Coeur d'Alene Lake

Status

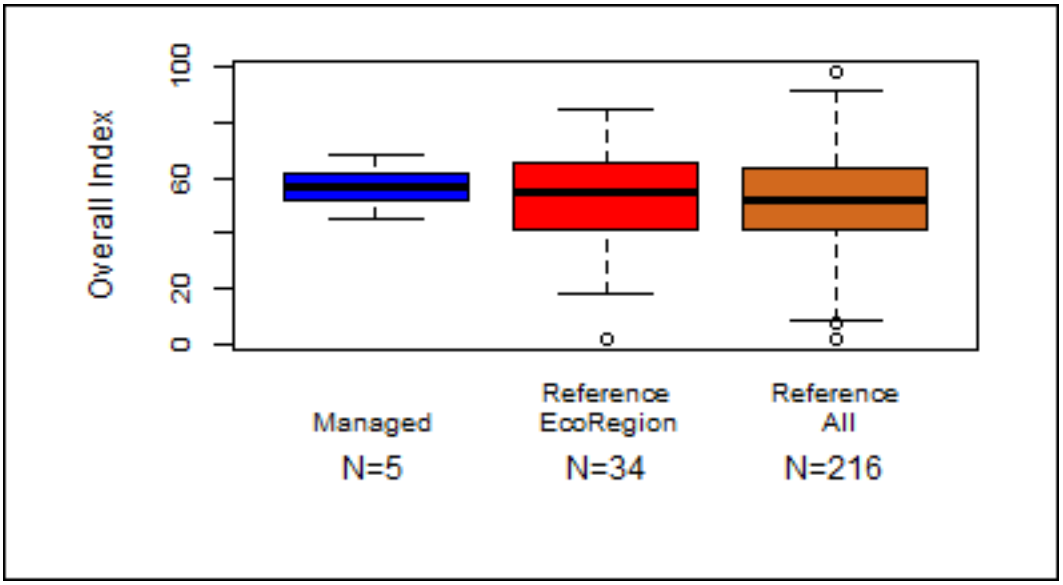

Figure 1. Overall Index values across the Coeur d'Alene Lake. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

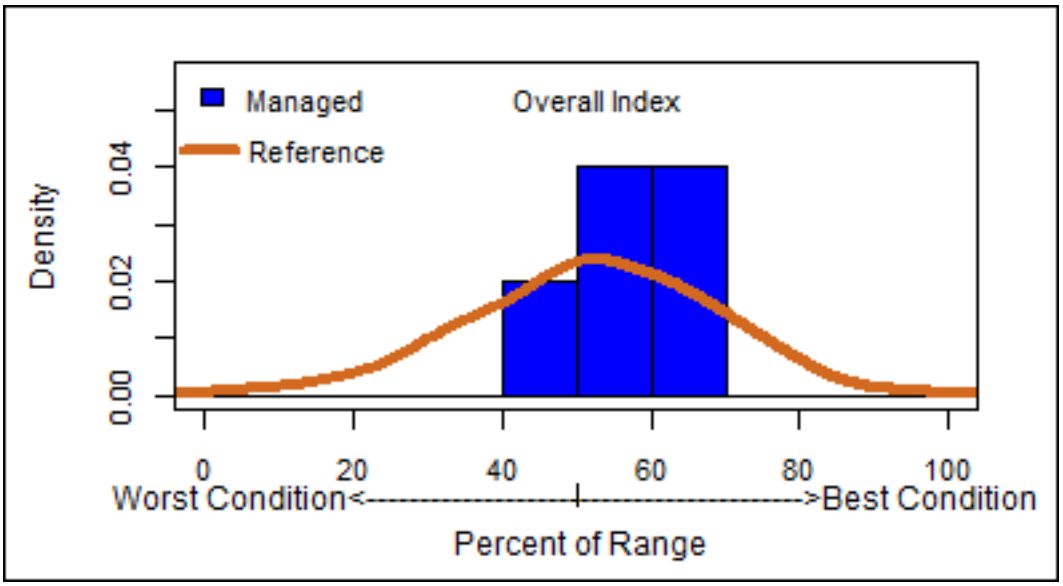

Figure 2. Overall Index values across the Coeur d'Alene Lake. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

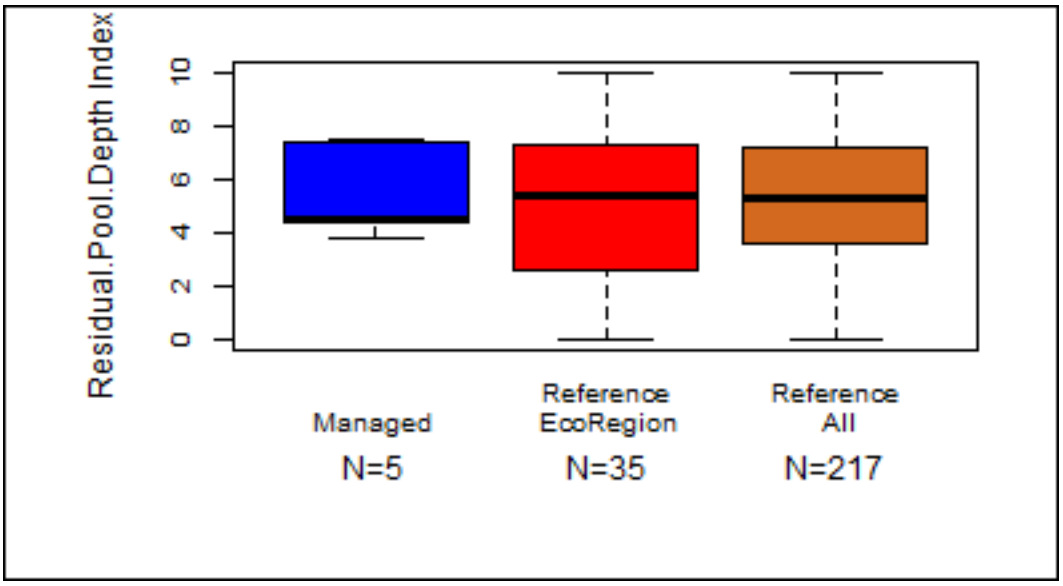

Figure 3. Residual Pool Depth Index values across the Coeur d'Alene Lake. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

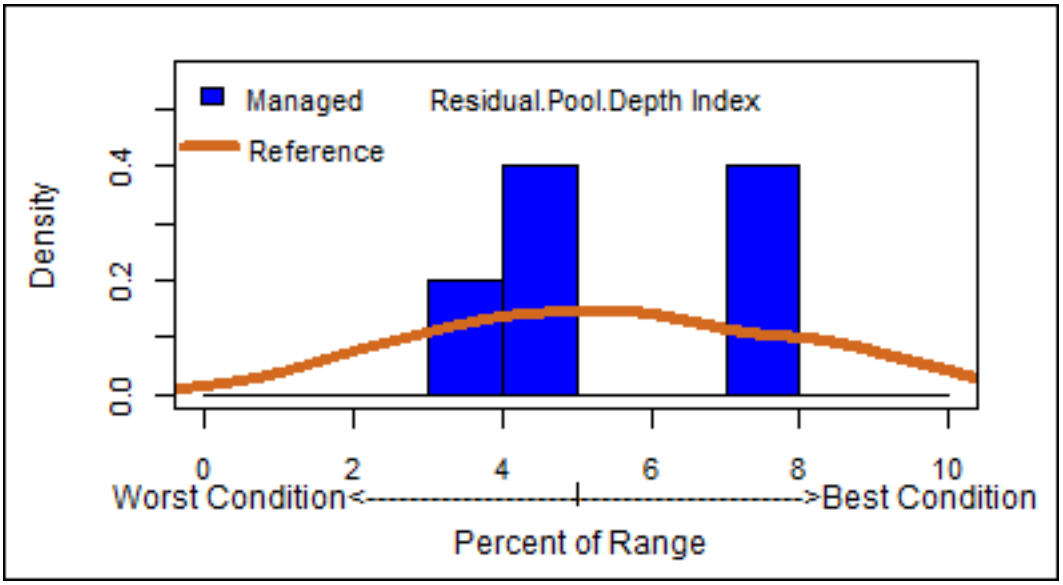

Figure 4. Residual Pool Depth Index values across the Coeur d'Alene Lake. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

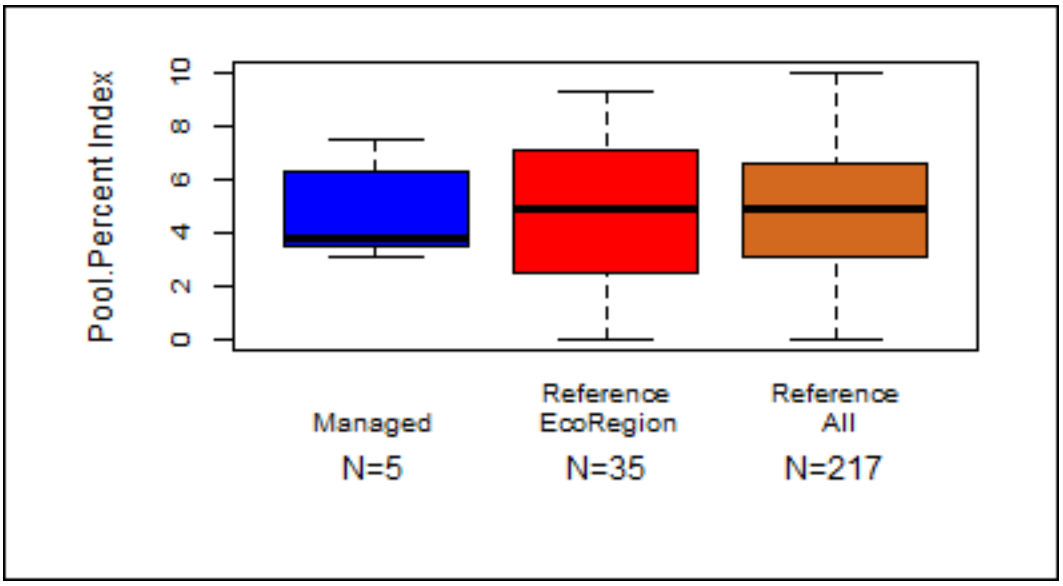

Figure 5. Pool Percent Index values across the Coeur d'Alene Lake. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

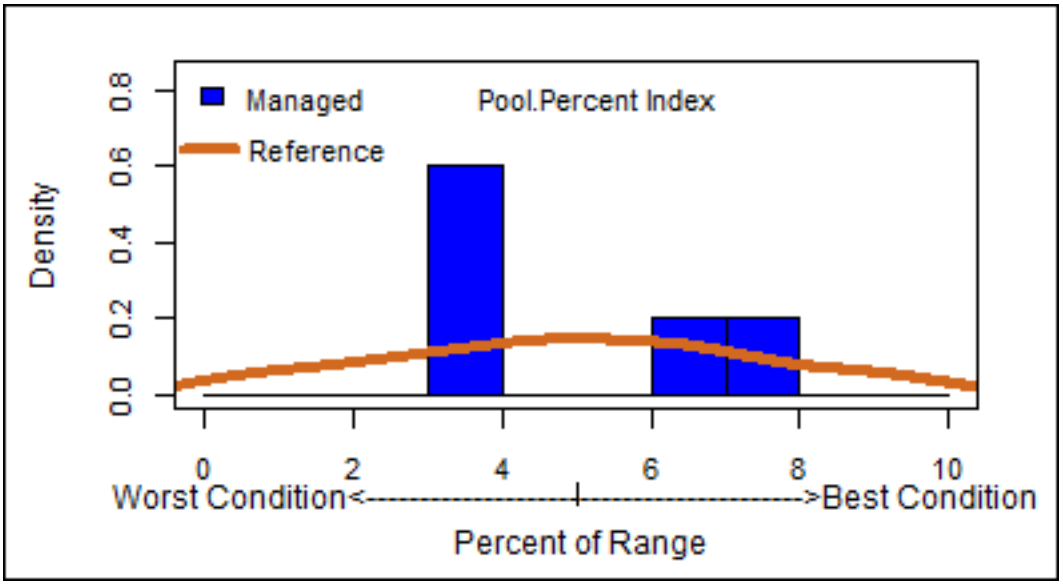

Figure 6. Pool Percent Index values across the Coeur d'Alene Lake. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

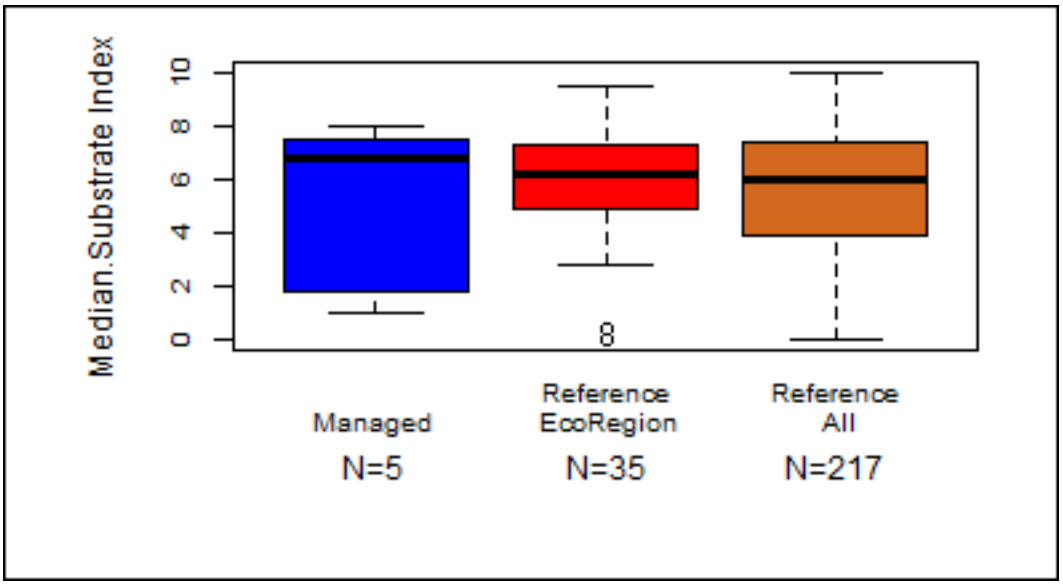

Figure 7. Median substrate Index values across the Coeur d'Alene Lake. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

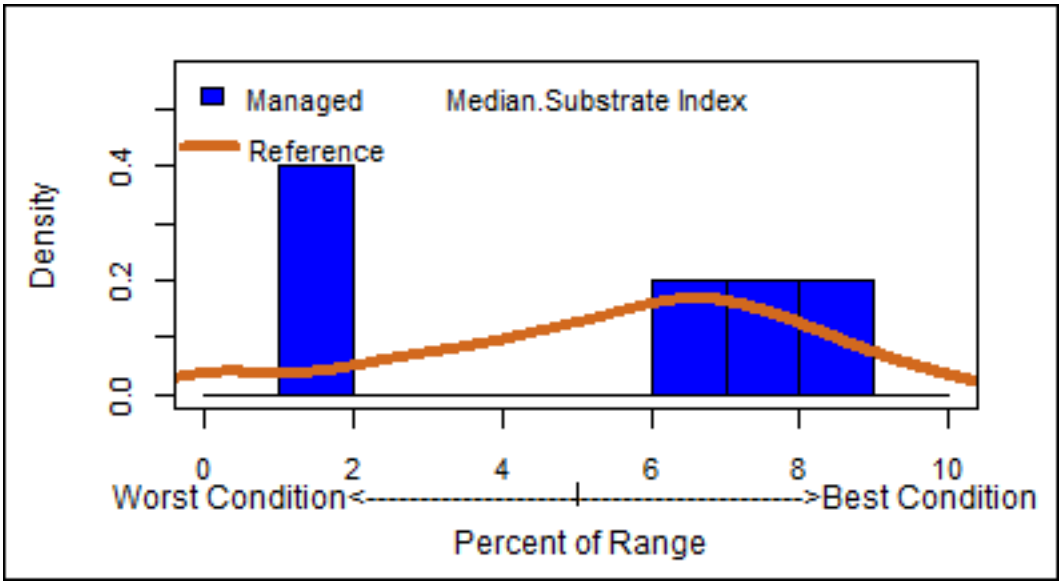

Figure 8. Median substrate Index values across the Coeur d'Alene Lake. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

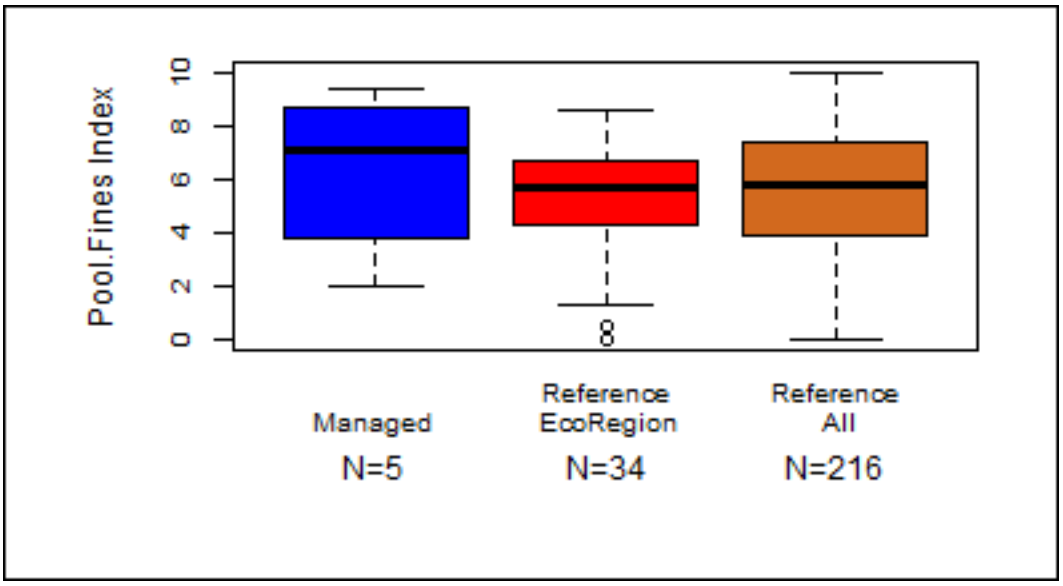

Figure 9. Pool Fines < 6 mm Index values across the Coeur d'Alene Lake. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

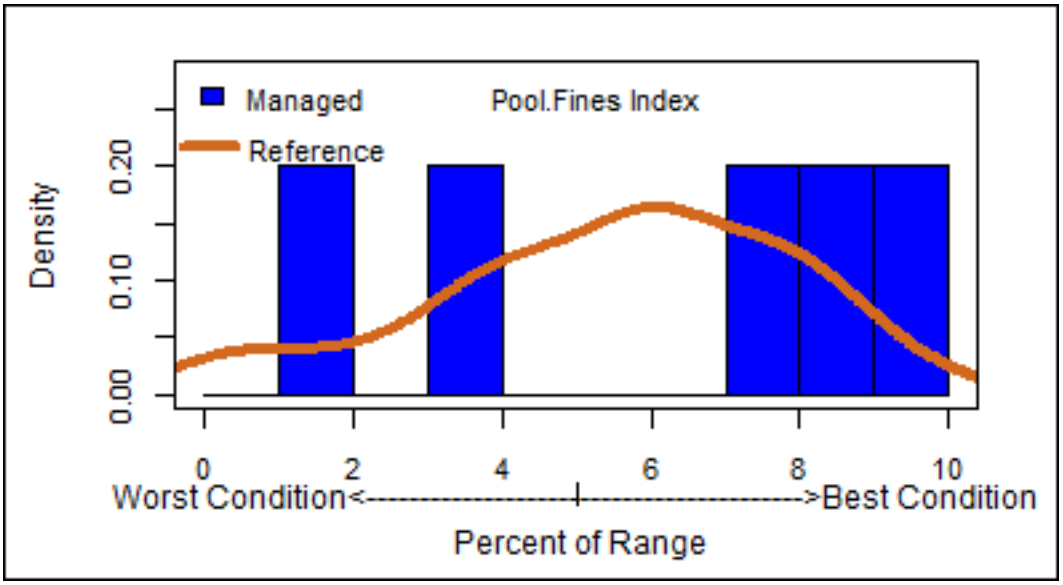

Figure 10. Pool Fines < 6 mm Index values across the Coeur d'Alene Lake. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

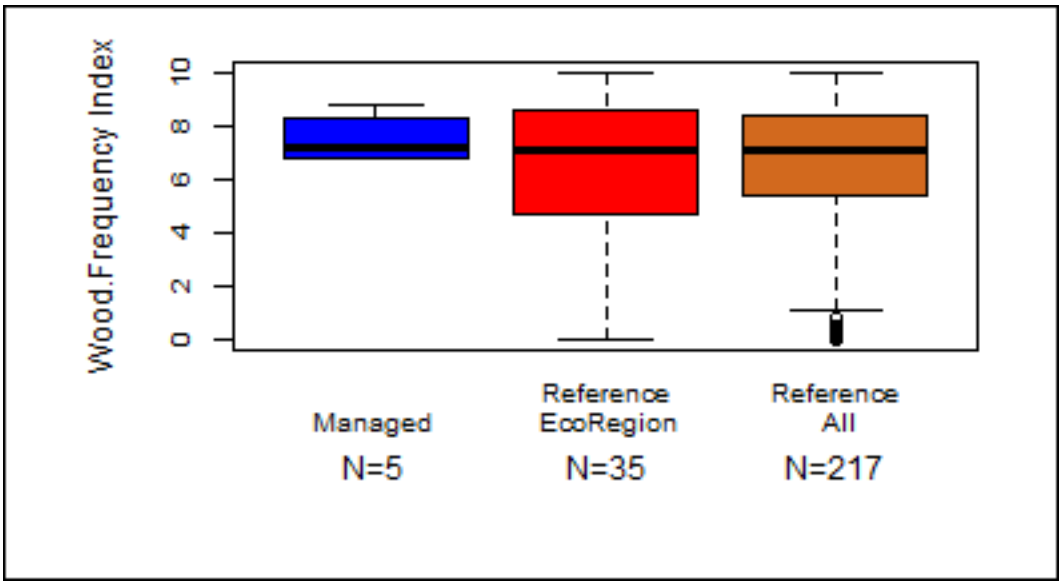

Figure 11. Wood Frequency Index values across the Coeur d'Alene Lake. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

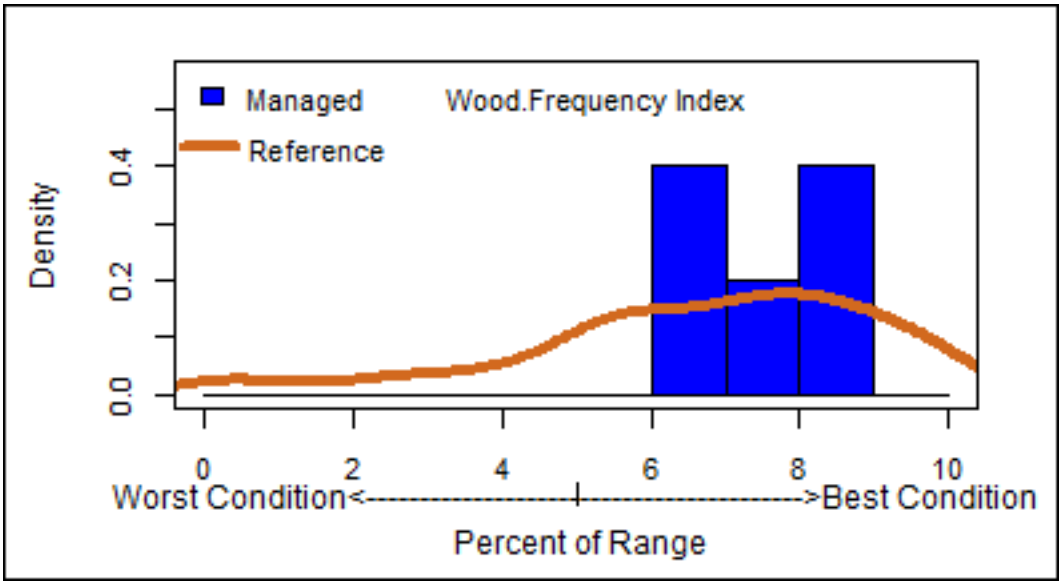

Figure 12. Wood Frequency Index values across the Coeur d'Alene Lake. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

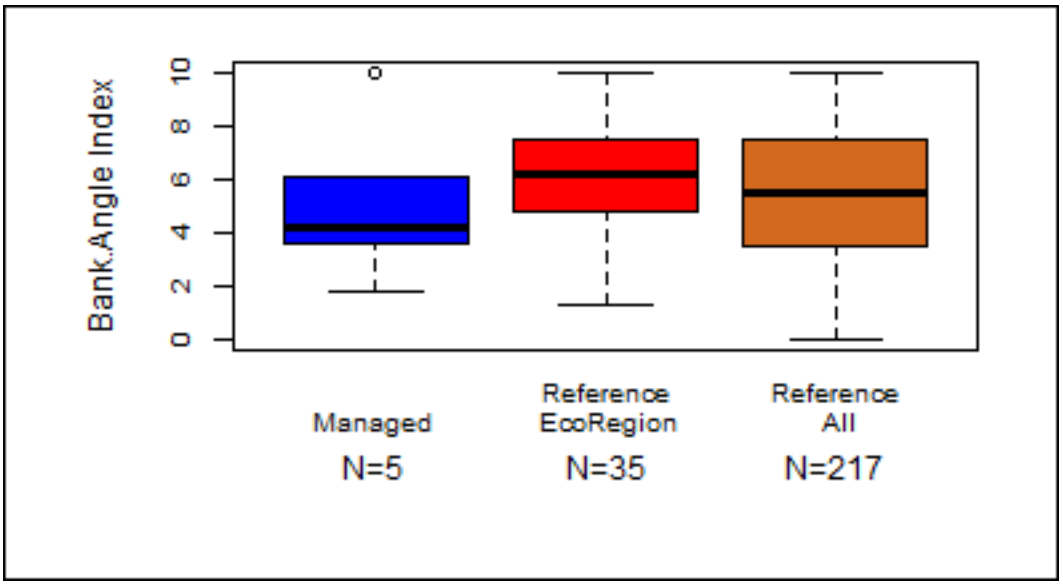

Figure 13. Bank Angle Index values across the Coeur d'Alene Lake. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

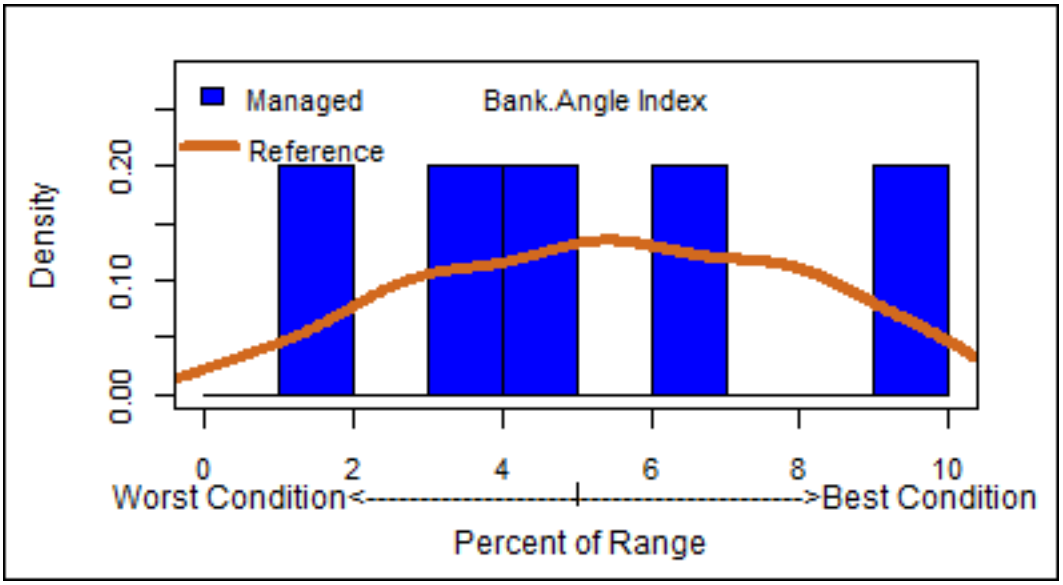

Figure 14. Bank Angle Index values across the Coeur d'Alene Lake. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

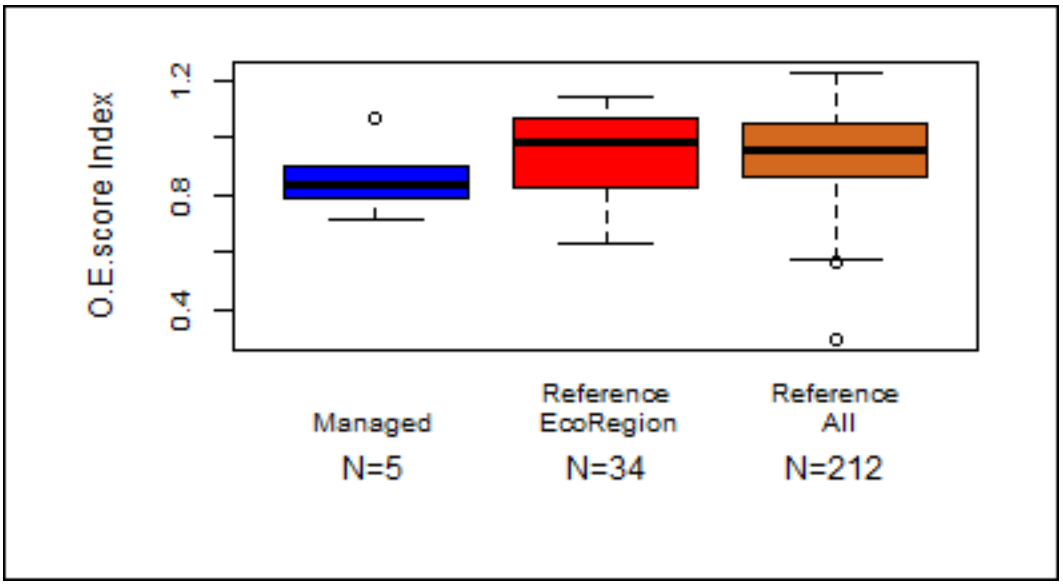

Figure 15. O/E Macroinvertebrate score Index values across the Coeur d'Alene Lake. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

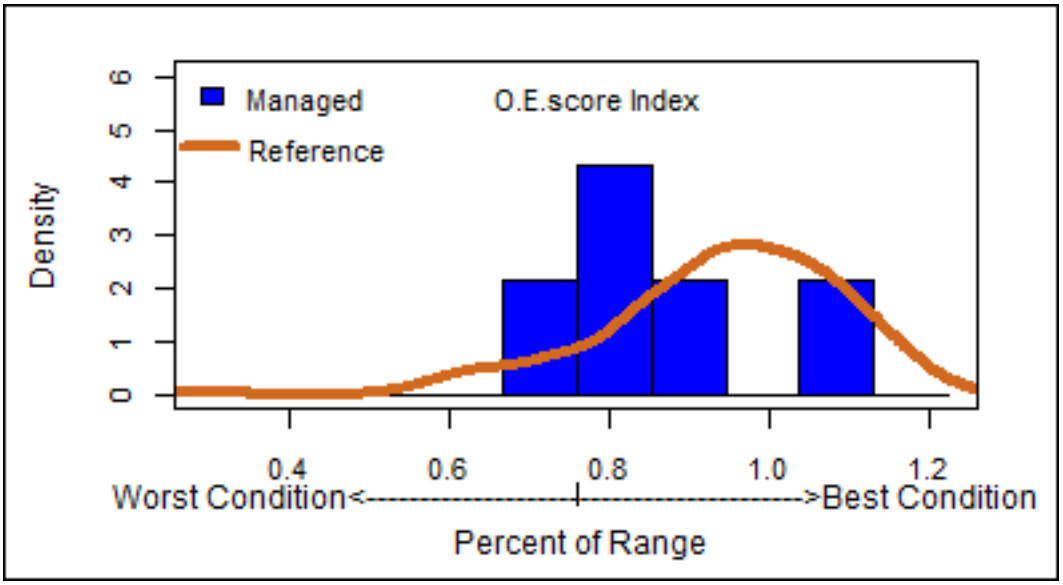

Figure 16. O/E Macroinvertebrate score Index values across the Coeur d'Alene Lake. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

Table1. Summary of Index Scores--Coeur d'Alene Lake; N=sample size, p-value=significance (0.05), sd=standard deviation, ci=95% confidence interval

InterestArea	Metric	Indexscore	N	pvalue	sd	ci
Managed	Overall	56.7	5	NA	8.75	8.34
Reference Local	Overall	NA	<3	NA	NA	NA
Reference Eco Region	Overall	51.68	34	0.34	18.31	5.32
Reference All	Overall	52.02	216	0.306	16.69	1.88
Managed	Residual.Pool.Depth	5.55	5	NA	1.78	1.7
Reference Local	Residual.Pool.Depth	NA	<3	NA	NA	NA
Reference Eco Region	Residual.Pool.Depth	5.23	35	0.739	2.87	0.82
Reference All	Residual.Pool.Depth	5.41	217	0.876	2.4	0.27
Managed	Pool.Percent	4.83	5	NA	1.95	1.86
Reference Local	Pool.Percent	NA	<3	NA	NA	NA
Reference Eco Region	Pool.Percent	4.81	35	0.988	2.73	0.78
Reference All	Pool.Percent	4.93	217	0.913	2.49	0.28
Managed	Median.Substrate	5.05	5	NA	3.33	3.17
Reference Local	Median.Substrate	NA	<3	NA	NA	NA
Reference Eco Region	Median.Substrate	5.84	35	0.628	2.08	0.59
Reference All	Median.Substrate	5.56	217	0.749	2.51	0.28
Managed	Pool.Fines	6.21	5	NA	3.2	3.05
Reference Local	Pool.Fines	NA	<3	NA	NA	NA
Reference Eco Region	Pool.Fines	5.25	34	0.545	2.01	0.58
Reference All	Pool.Fines	5.49	216	0.64	2.39	0.27
Managed	Wood.Frequency	7.58	5	NA	0.88	0.84
Reference Local	Wood.Frequency	NA	<3	NA	NA	NA
Reference Eco Region	Wood.Frequency	6.09	35	0.03	3	0.86
Reference All	Wood.Frequency	6.62	217	0.068	2.38	0.27
Managed	Bank.Angle	5.14	5	NA	3.11	2.96
Reference Local	Bank.Angle	NA	<3	NA	NA	NA
Reference Eco Region	Bank.Angle	5.94	35	0.607	2.35	0.67
Reference All	Bank.Angle	5.45	217	0.836	2.54	0.29
Managed	O.E.score	0.86	5	NA	0.13	0.13
Reference Local	O.E.score	NA	<3	NA	NA	NA
Reference Eco Region	O.E.score	0.95	34	0.222	0.14	0.04
Reference All	O.E.score	0.94	212	0.242	0.15	0.02

Trend

Table 2 .Trend in stream habitat attributes across the Coeur d'Alene Lake Subbasin including: Overall_Index score, O.E. (Observed/Expected macroinvertebrate score), VegStab (bank stability), UnCutPct (percent undercut banks), LWFrq (large wood frequency), Bank Angle, PTFines6 (percent fines in pool tails), D50 (median substrate size), RPD (residual pool depth), and PoolPct (percent pools). Refer to page 5 of methods (Heading: 'Summary Tables') for further explanation. Time1 = mean during first visit; Time2 = mean value for last visit; Percent Change = Percent change in the mean values between the first and last visit; Sample size = number of observations with repeat visits; Negative Number = Number of sites where actual measurement was lower on last visit; Positive Number = Number of sites where actual measurement was higher in last visit; None Number = Number of sites where last visit and first visit values were equal; P-value = Significance test; Desired Direction = direction of change in the mean, which can be either + or -; Actual Change = actual direction of change in the mean, which can be not statistically significant (NS), + or -.

Metric	Time1 Value	Time2 Value	Percent Change	Sample Size	Negative Number	Positive Number	No Change Number	P-value	Desired Direction	Actual Change
Overall_Index	54.65	54.95	0.6	5	1	4	0	0.5	+	NS
O.E.	0.89	0.83	-7.7	5	4	1	0	0.138	+	NS
VegStab	74.27	79.71	7.3	5	2	3	0	0.686	+	NS
UnCutPct	25.83	29.66	14.9	5	2	3	0	0.5	+	NS
LWFrq	281.02	345.66	23	5	2	3	0	0.686	+	NS
BankAngle	117.6	108.4	-7.8	5	4	1	0	0.138	-	NS
PTFines6	21.67	8.18	-62.3	5	5	0	0	0.043	-	-
D50	0.0397	0.0416	4.8	5	2	2	1	0.465	+	NS
RPD	0.33	0.29	-13.3	5	4	1	0	0.138	+	NS
PoolPct	40.95	37.72	-7.9	5	3	2	0	0.686	+	NS

Status

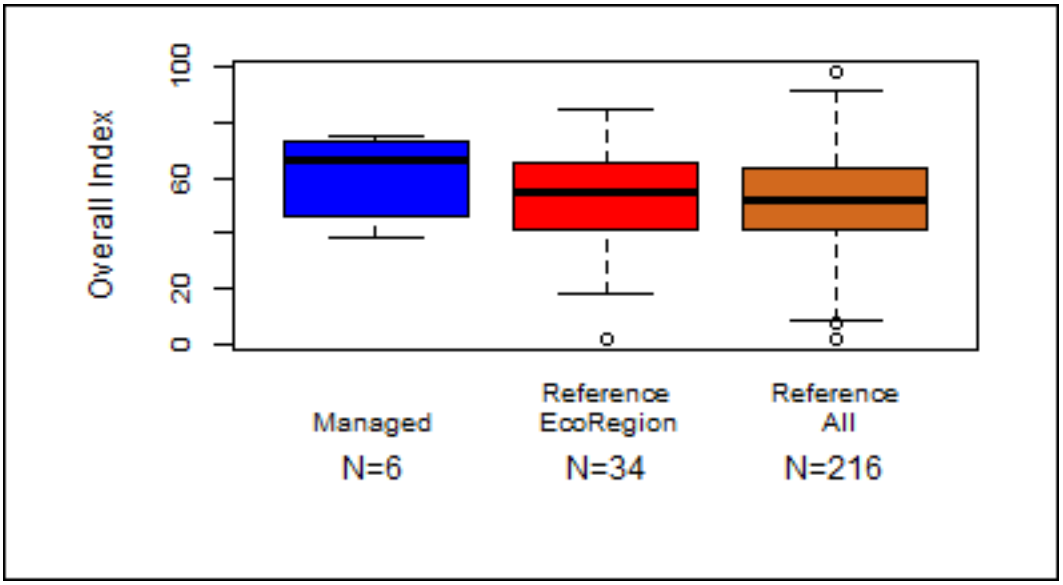

Figure 1. Overall Index values across the Moyie. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

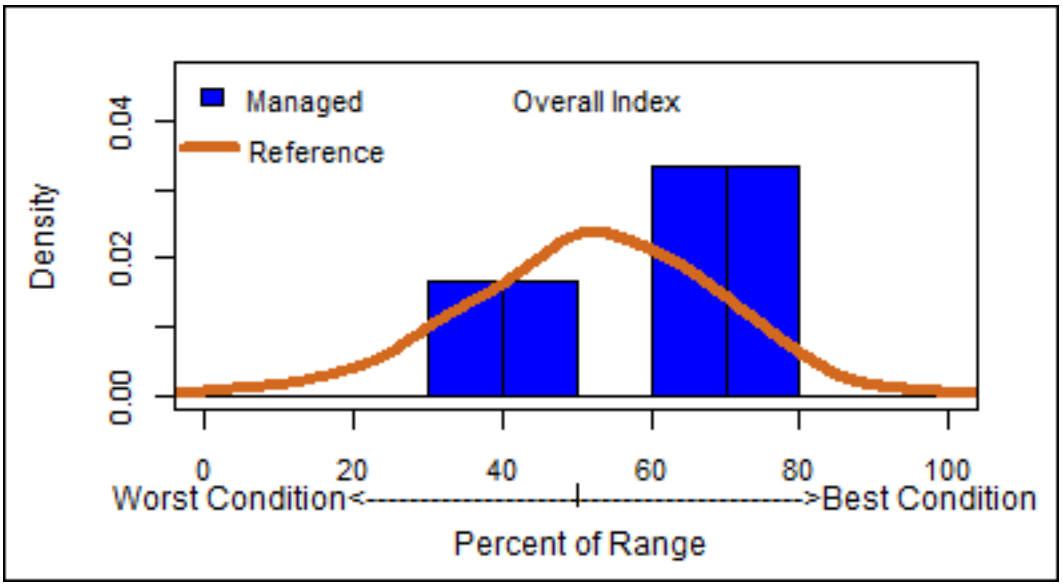

Figure 2. Overall Index values across the Moyie. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

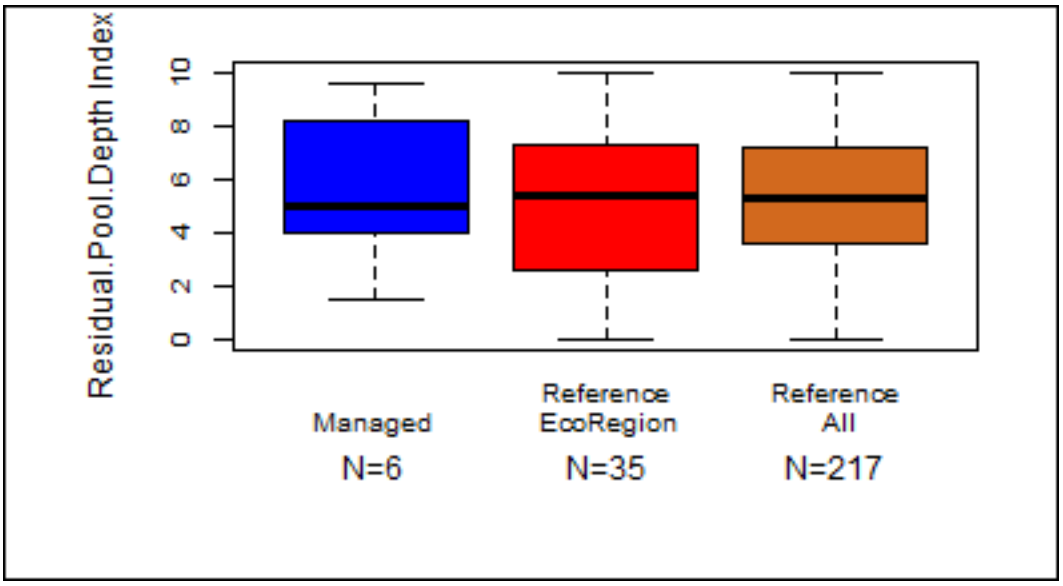

Figure 3. Residual Pool Depth Index values across the Moyie. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

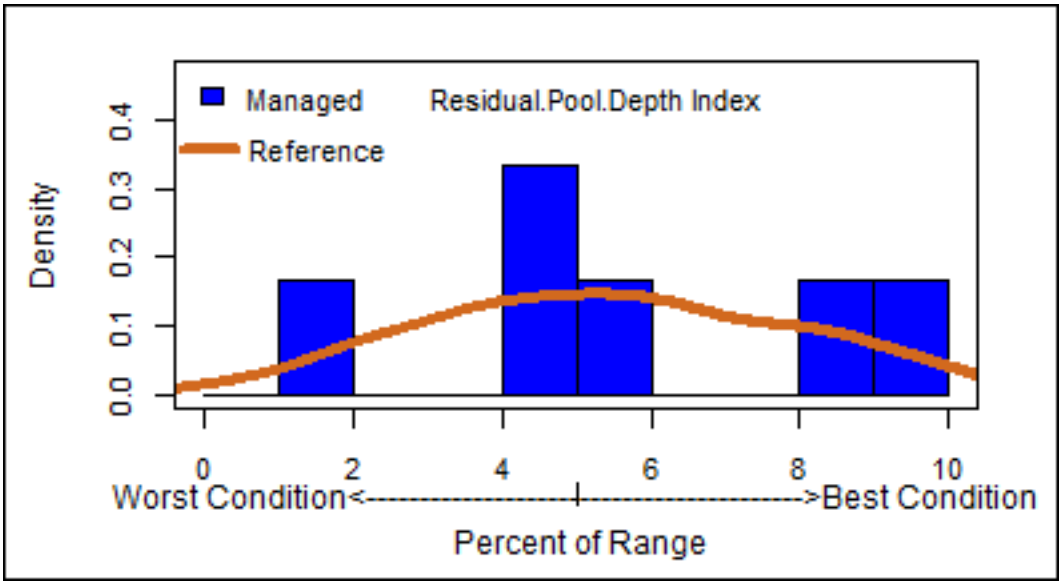

Figure 4. Residual Pool Depth Index values across the Moyie. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

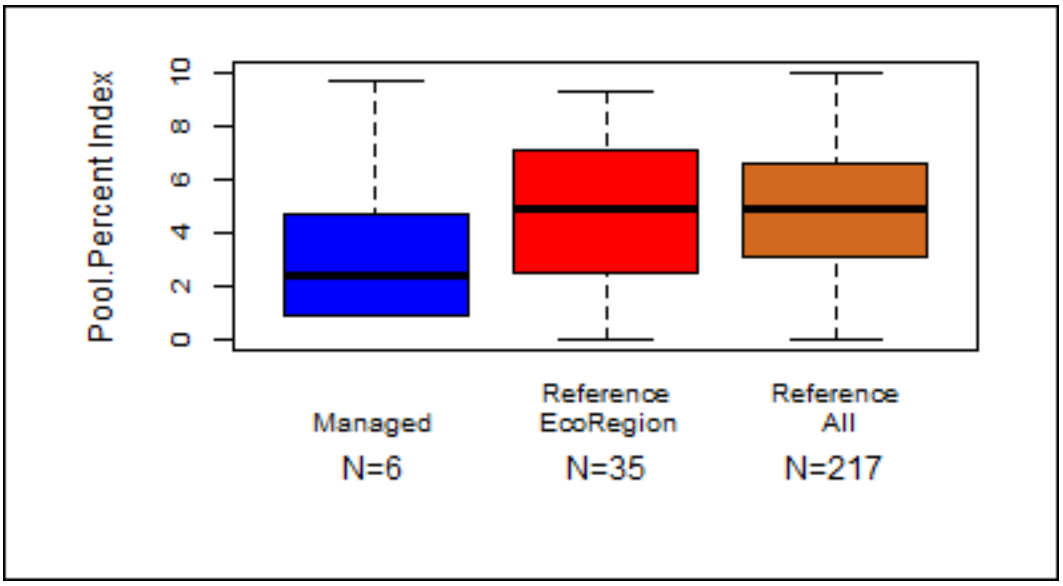

Figure 5. Pool Percent Index values across the Moyie. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

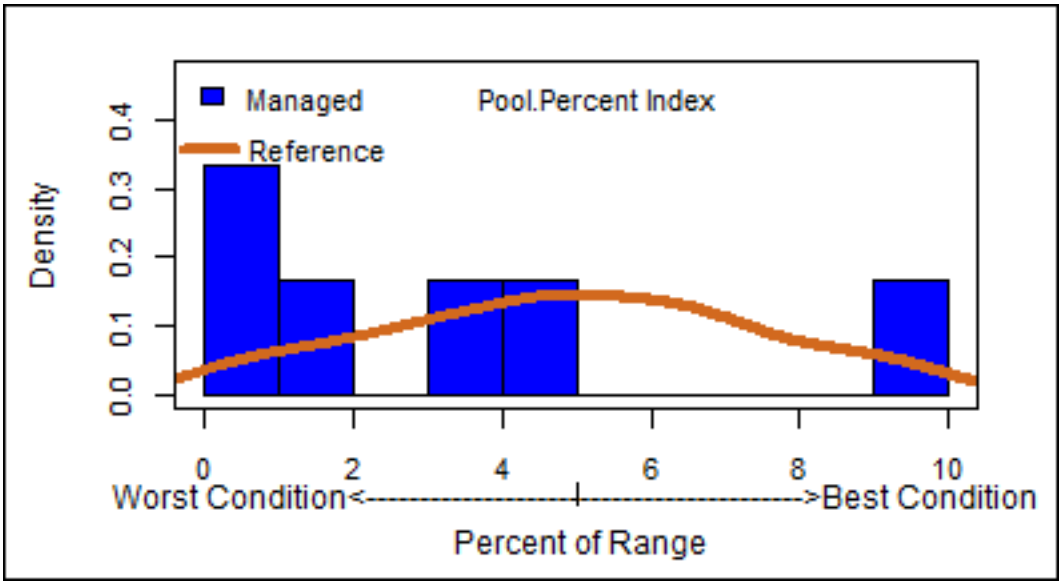

Figure 6. Pool Percent Index values across the Moyie. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

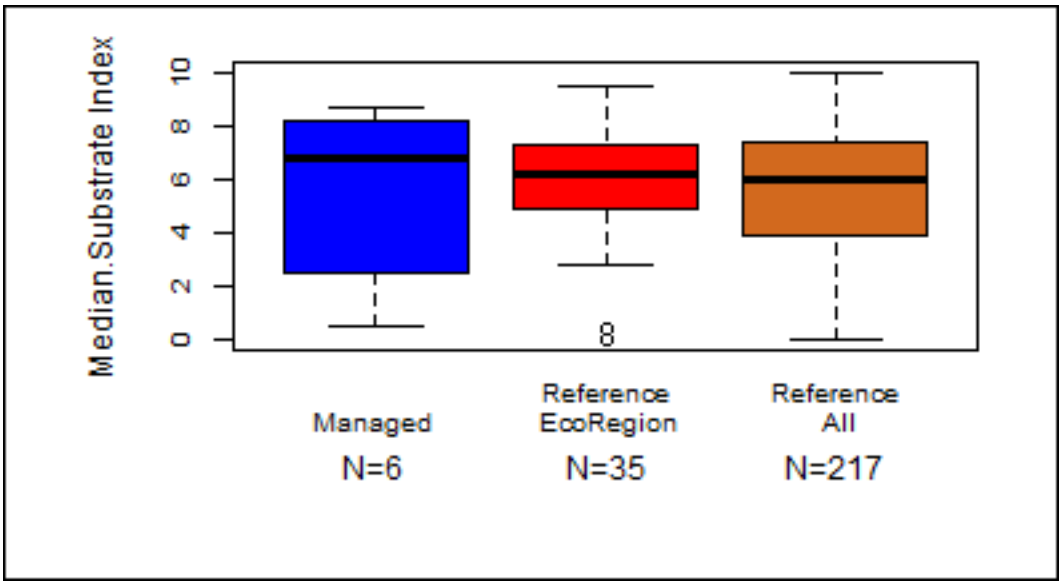

Figure 7. Median substrate Index values across the Moyie. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

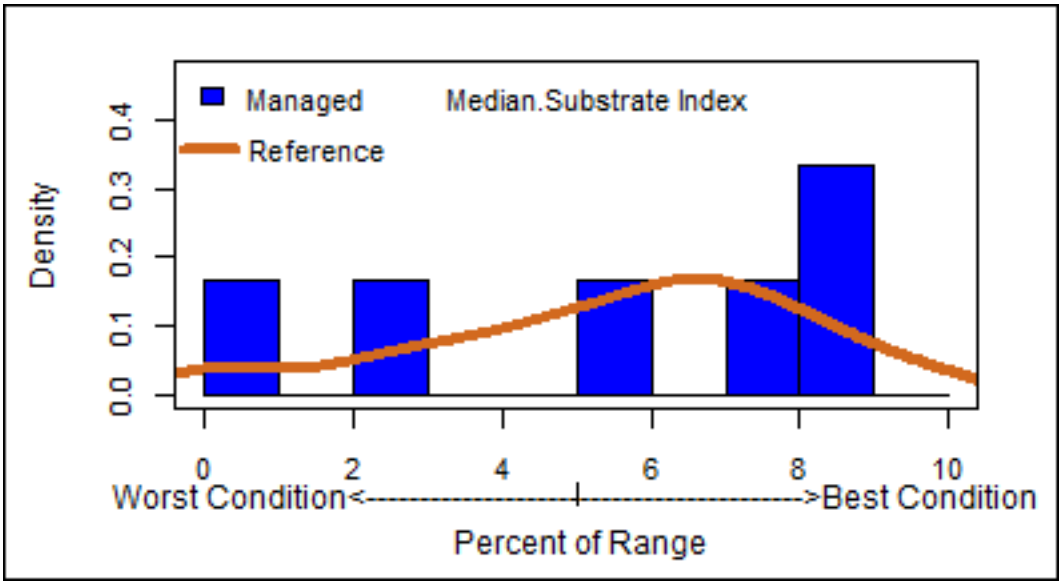

Figure 8. Median substrate Index values across the Moyie. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

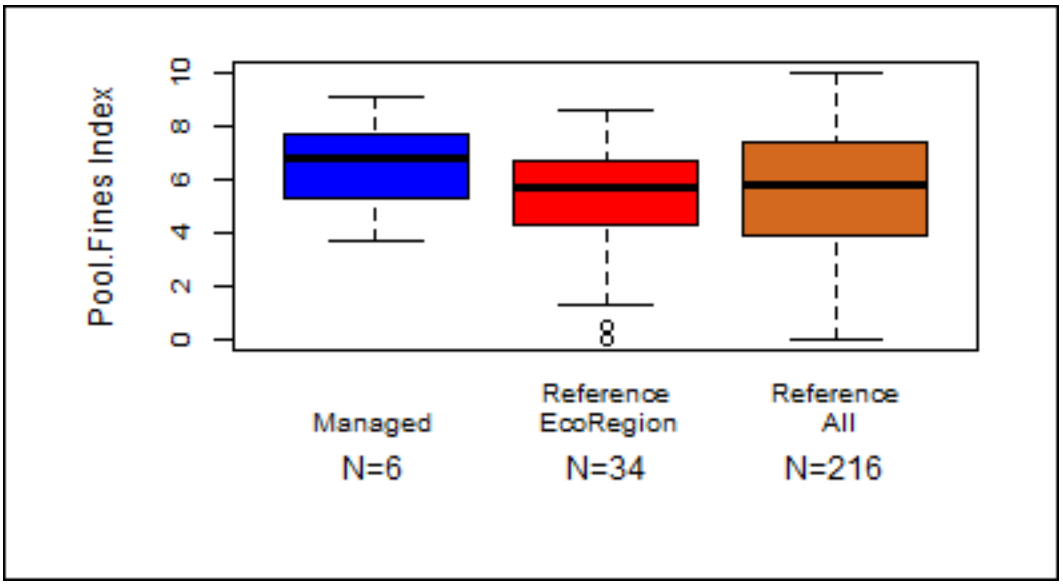

Figure 9. Pool Fines < 6 mm Index values across the Moyie. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

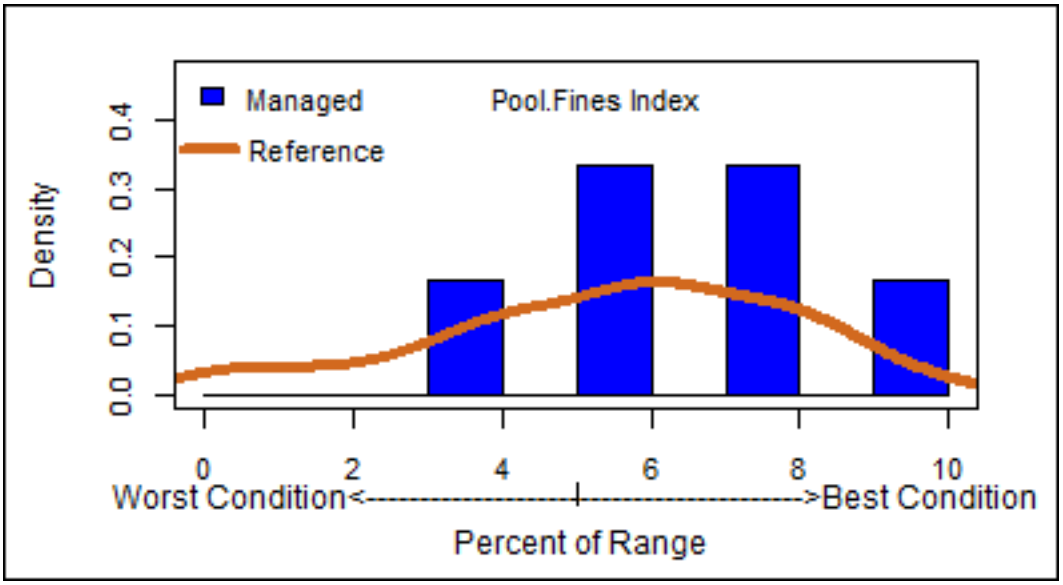

Figure 10. Pool Fines < 6 mm Index values across the Moyie. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

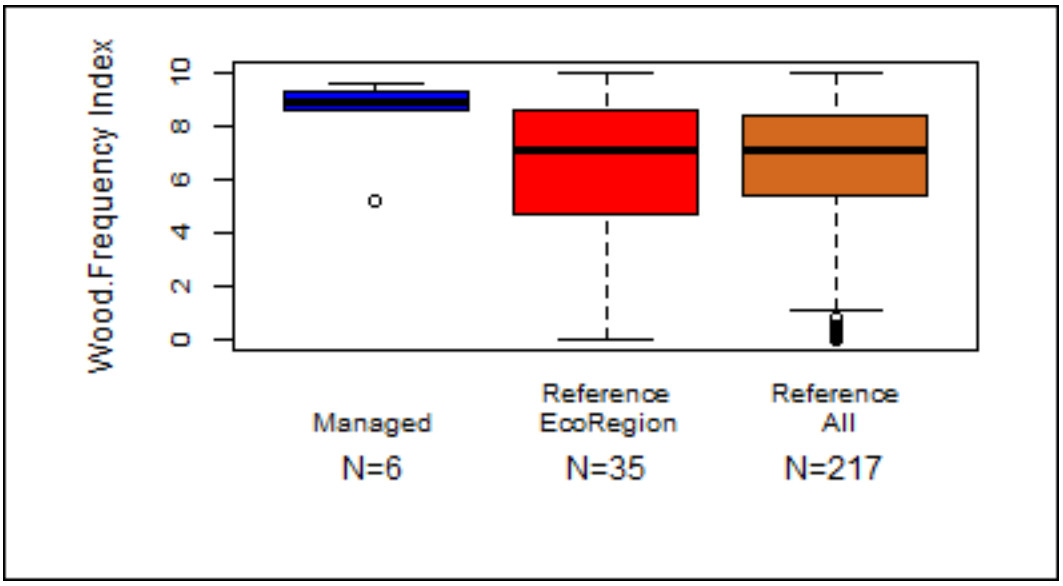

Figure 11. Wood Frequency Index values across the Moyie. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

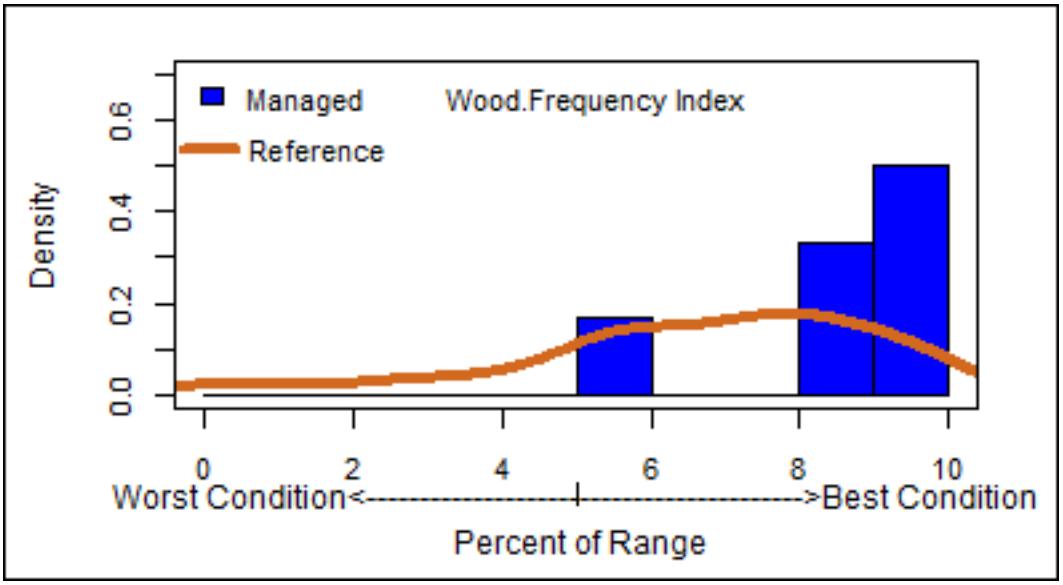

Figure 12. Wood Frequency Index values across the Moyie. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

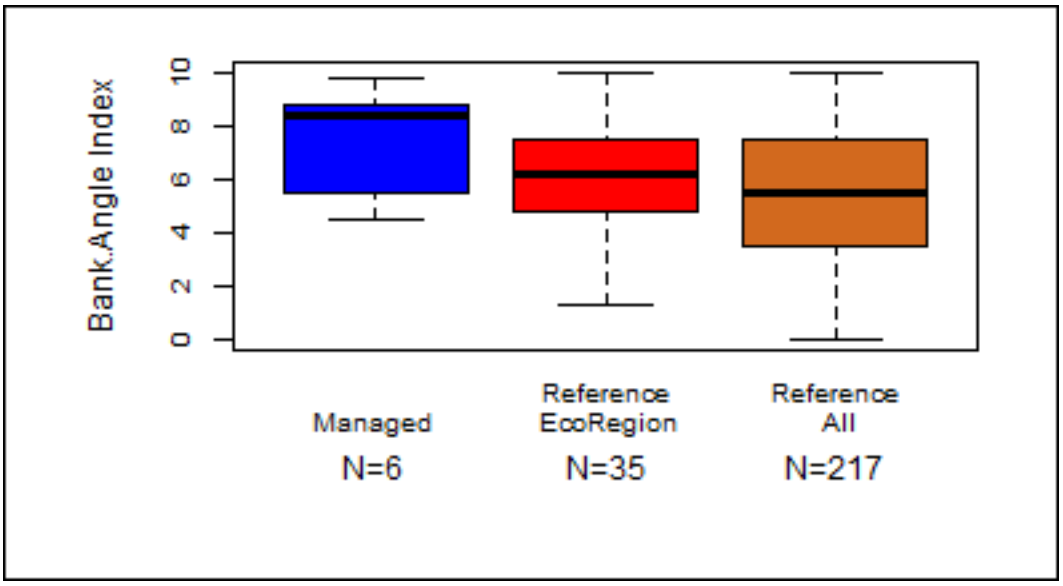

Figure 13. Bank Angle Index values across the Moyie. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

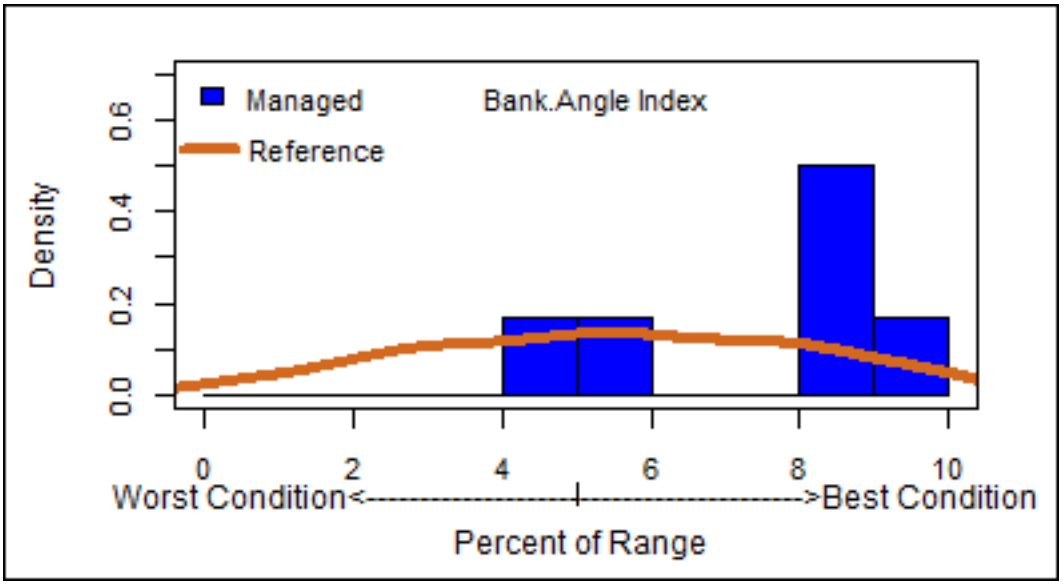

Figure 14. Bank Angle Index values across the Moyie. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

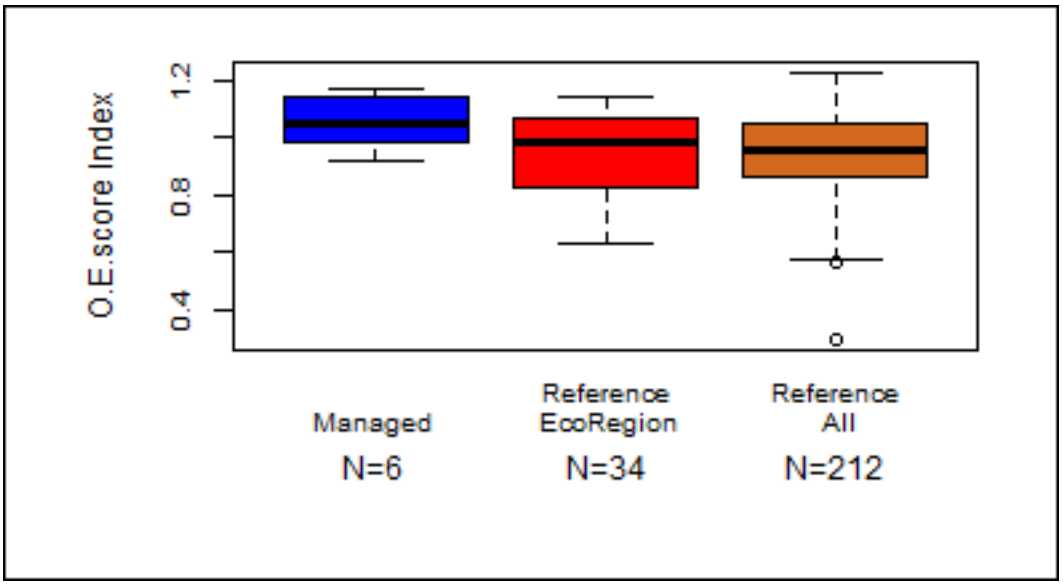

Figure 15. O/E Macroinvertebrate score Index values across the Moyie. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

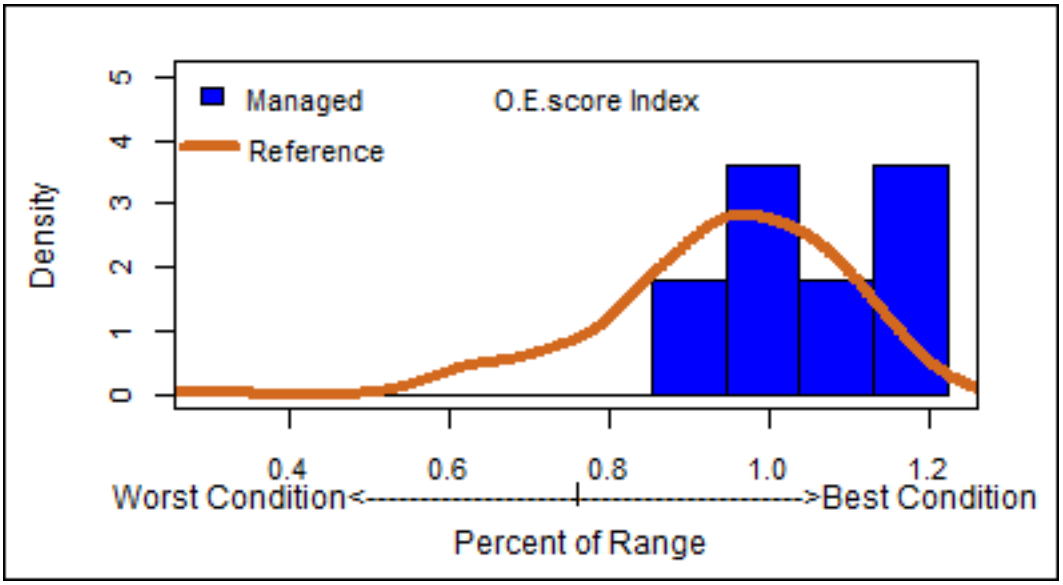

Figure 16. O/E Macroinvertebrate score Index values across the Moyie. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

Table1. Summary of Index Scores--Moyie; N=sample size, p-value=significance (0.05), sd=standard deviation, ci=95% confidence interval

InterestArea	Metric	Indexscore	N	pvalue	sd	ci
Managed	Overall	60.95	6	NA	15.23	12.53
Reference Local	Overall	NA	<3	NA	NA	NA
Reference Eco Region	Overall	51.68	34	0.221	18.31	5.32
Reference All	Overall	52.02	216	0.213	16.69	1.88
Managed	Residual.Pool.Depth	5.55	6	NA	2.94	2.42
Reference Local	Residual.Pool.Depth	NA	<3	NA	NA	NA
Reference Eco Region	Residual.Pool.Depth	5.23	35	0.808	2.87	0.82
Reference All	Residual.Pool.Depth	5.41	217	0.913	2.4	0.27
Managed	Pool.Percent	3.53	6	NA	3.41	2.8
Reference Local	Pool.Percent	NA	<3	NA	NA	NA
Reference Eco Region	Pool.Percent	4.81	35	0.415	2.73	0.78
Reference All	Pool.Percent	4.93	217	0.363	2.49	0.28
Managed	Median.Substrate	5.6	6	NA	3.38	2.78
Reference Local	Median.Substrate	NA	<3	NA	NA	NA
Reference Eco Region	Median.Substrate	5.84	35	0.868	2.08	0.59
Reference All	Median.Substrate	5.56	217	0.981	2.51	0.28
Managed	Pool.Fines	6.57	6	NA	1.95	1.6
Reference Local	Pool.Fines	NA	<3	NA	NA	NA
Reference Eco Region	Pool.Fines	5.25	34	0.173	2.01	0.58
Reference All	Pool.Fines	5.49	216	0.238	2.39	0.27
Managed	Wood.Frequency	8.41	6	NA	1.6	1.31
Reference Local	Wood.Frequency	NA	<3	NA	NA	NA
Reference Eco Region	Wood.Frequency	6.09	35	0.016	3	0.86
Reference All	Wood.Frequency	6.62	217	0.04	2.38	0.27
Managed	Bank.Angle	7.57	6	NA	2.1	1.73
Reference Local	Bank.Angle	NA	<3	NA	NA	NA
Reference Eco Region	Bank.Angle	5.94	35	0.126	2.35	0.67
Reference All	Bank.Angle	5.45	217	0.056	2.54	0.29
Managed	O.E.score	1.05	6	NA	0.09	0.08
Reference Local	O.E.score	NA	<3	NA	NA	NA
Reference Eco Region	O.E.score	0.95	34	0.052	0.14	0.04
Reference All	O.E.score	0.94	212	0.037	0.15	0.02

Trend

Table 2 .Trend in stream habitat attributes across the Moyie Subbasin including: Overall_Index score, O.E. (Observed/Expected macroinvertebrate score), VegStab (bank stability), UnCutPct (percent undercut banks), LWFrq (large wood frequency), Bank Angle, PTFines6 (percent fines in pool tails), D50 (median substrate size), RPD (residual pool depth), and PoolPct (percent pools). Refer to page 5 of methods (Heading: 'Summary Tables') for further explanation. Time1 = mean during first visit; Time2 = mean value for last visit; Percent Change = Percent change in the mean values between the first and last visit; Sample size = number of observations with repeat visits; Negative Number = Number of sites where actual measurement was lower on last visit; Positive Number = Number of sites where actual measurement was higher in last visit; None Number = Number of sites where last visit and first visit values were equal; P-value = Significance test; Desired Direction = direction of change in the mean, which can be either + or -; Actual Change = actual direction of change in the mean, which can be not statistically significant (NS), + or -.

Metric	Time1 Value	Time2 Value	Percent Change	Sample Size	Negative Number	Positive Number	No Change Number	P-value	Desired Direction	Actual Change
Overall_Index	60	62.77	4.6	6	1	5	0	0.249	+	NS
O.E.	1.12	1.03	-7.7	6	4	2	0	0.249	+	NS
VegStab	67.62	83.84	24	6	1	5	0	0.046	+	+
UnCutPct	33.18	47.88	44.3	6	1	5	0	0.046	+	+
LWFrq	383.3	544.6	42.1	6	2	4	0	0.463	+	NS
BankAngle	109.5	96.67	-11.7	6	5	1	0	0.116	-	NS
PTFines6	3.16	3.29	4.2	6	4	2	0	0.917	-	NS
D50	0.0692	0.0777	12.3	6	1	5	0	0.249	+	NS
RPD	0.29	0.34	19.8	6	2	4	0	0.173	+	NS
PoolPct	32.35	19.45	-39.9	6	4	2	0	0.116	+	NS

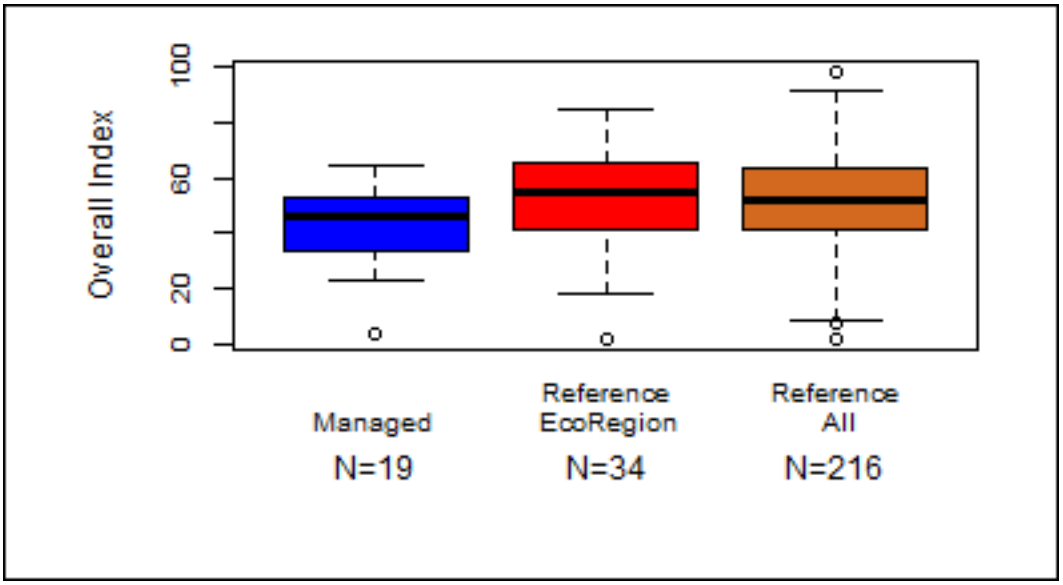

Figure 1. Overall Index values across the St. Joe. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

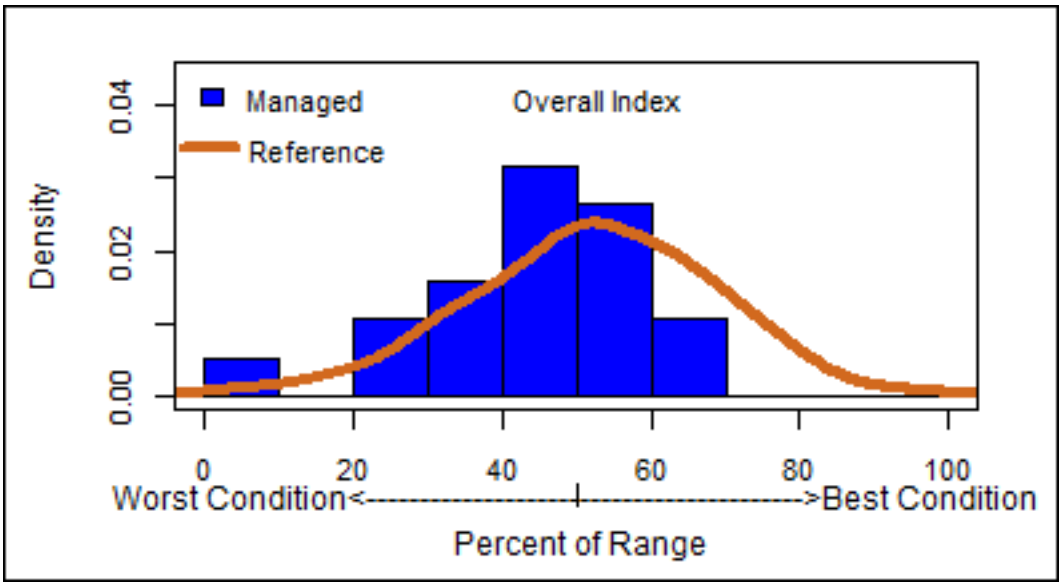

Figure 2. Overall Index values across the St. Joe. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

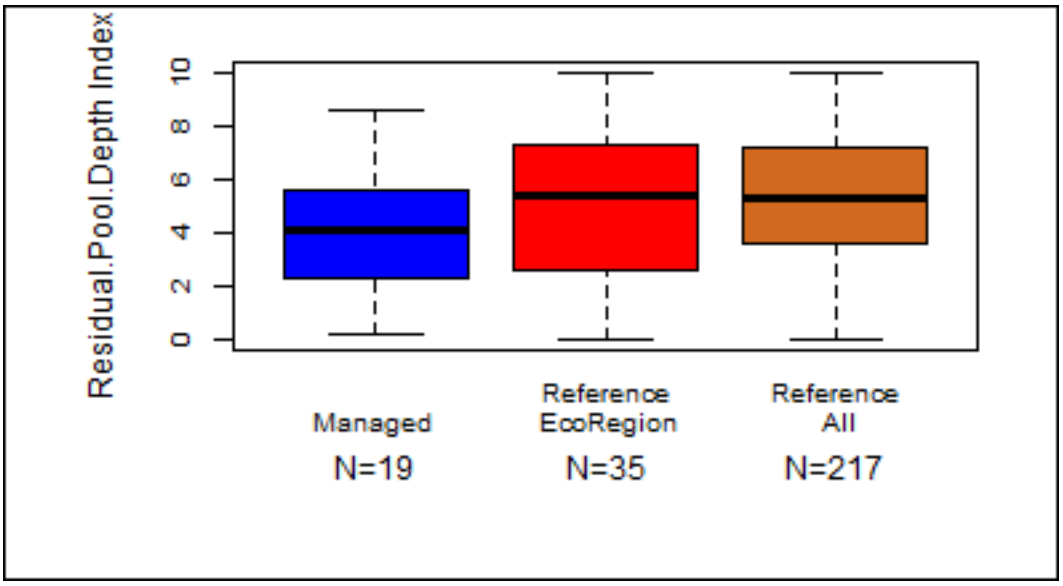

Figure 3. Residual Pool Depth Index values across the St. Joe. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

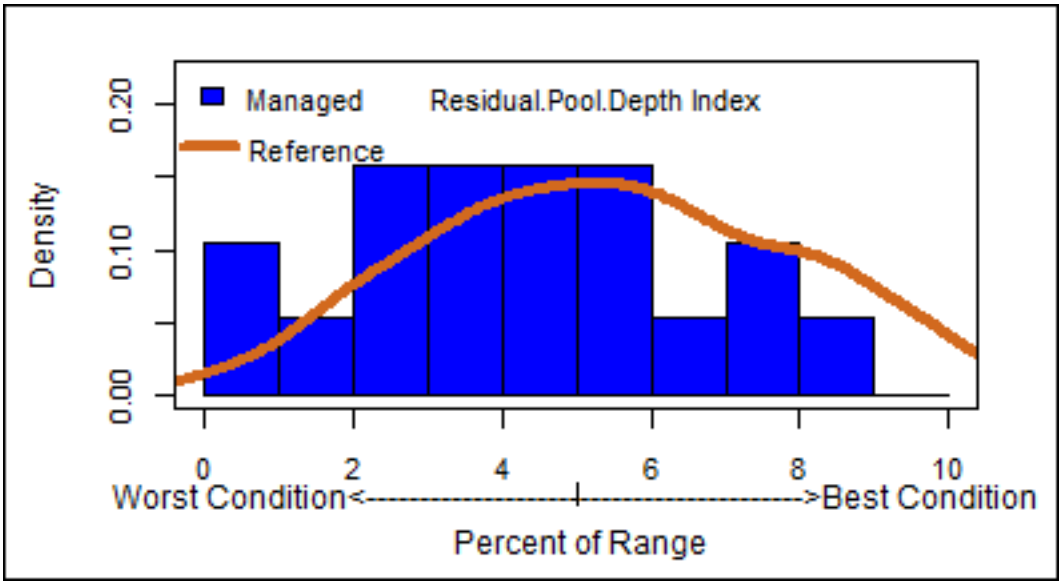

Figure 4. Residual Pool Depth Index values across the St. Joe. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

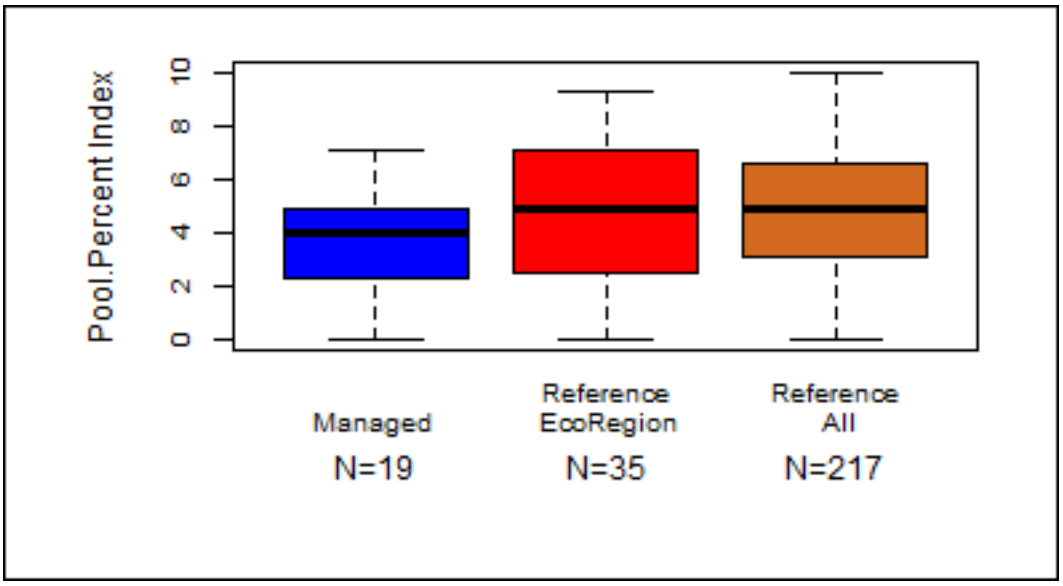

Figure 5. Pool Percent Index values across the St. Joe. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

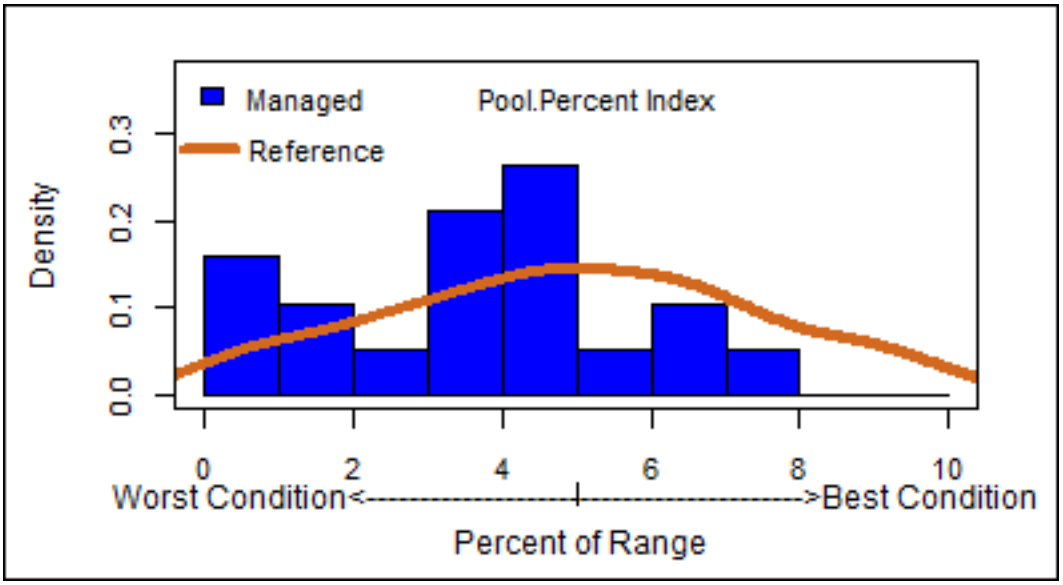

Figure 6. Pool Percent Index values across the St. Joe. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

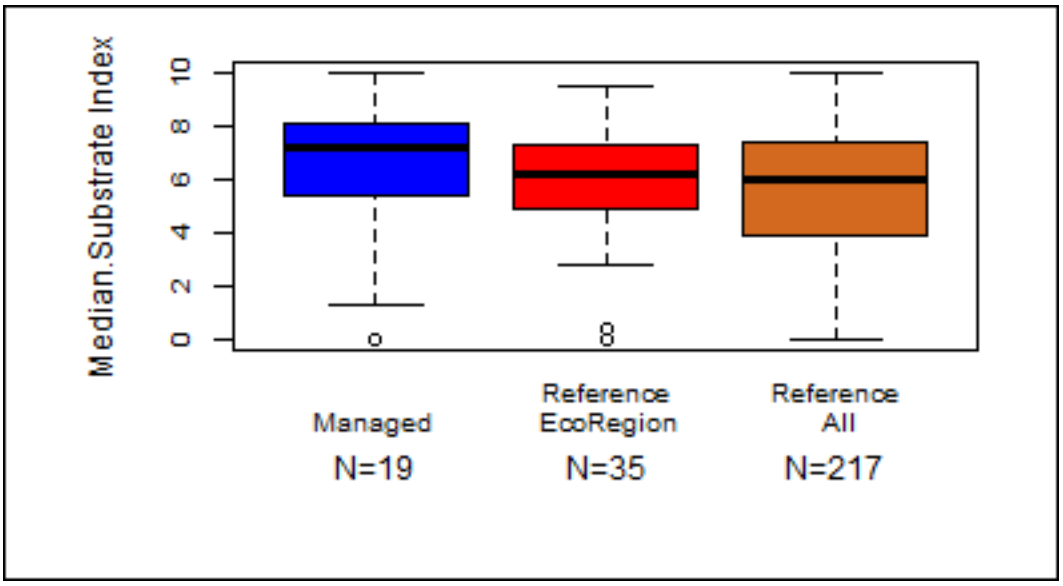

Figure 7. Median substrate Index values across the St. Joe. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

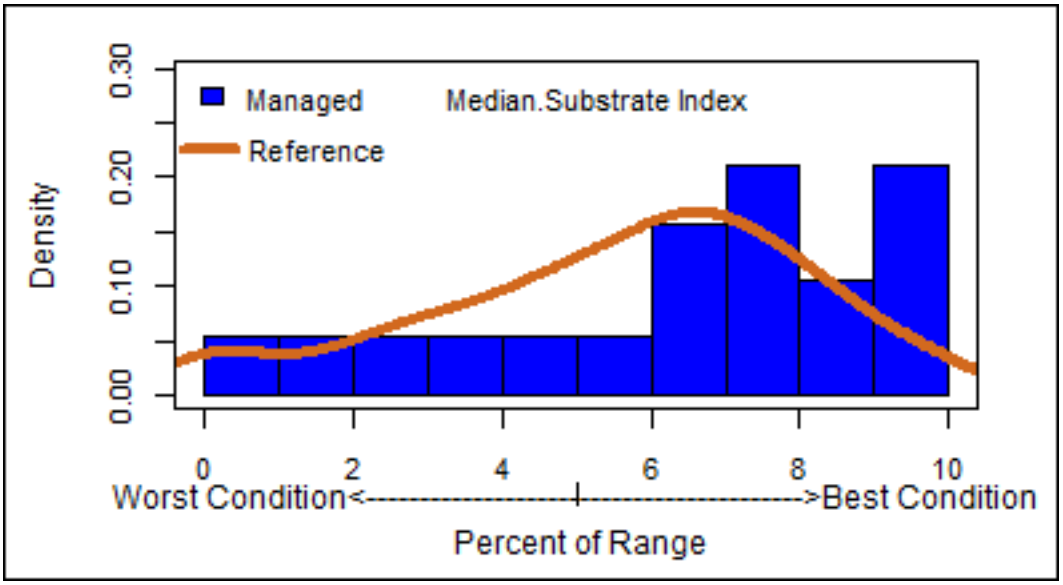

Figure 8. Median substrate Index values across the St. Joe. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

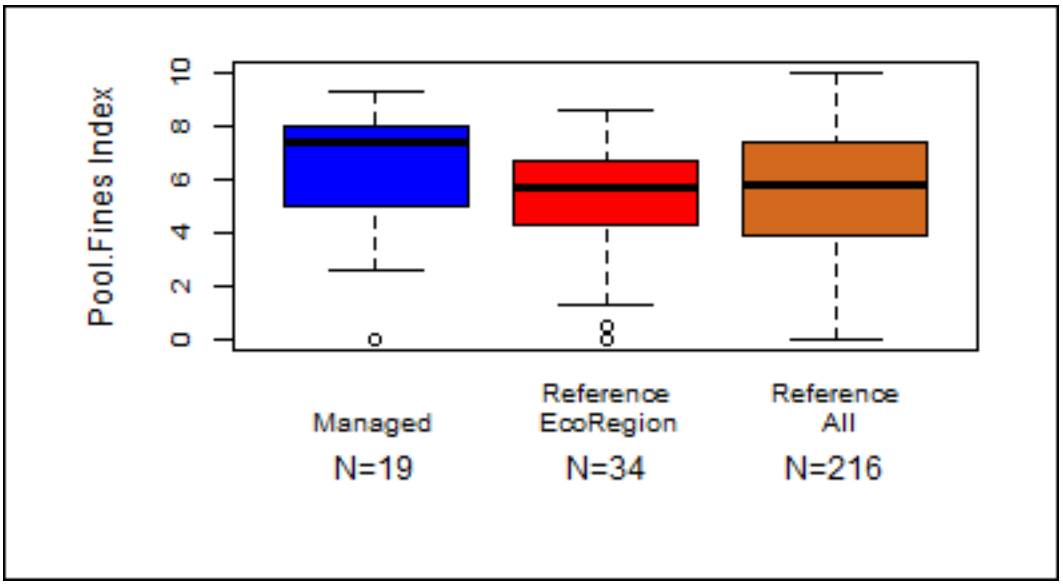

Figure 9. Pool Fines < 6 mm Index values across the St. Joe. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

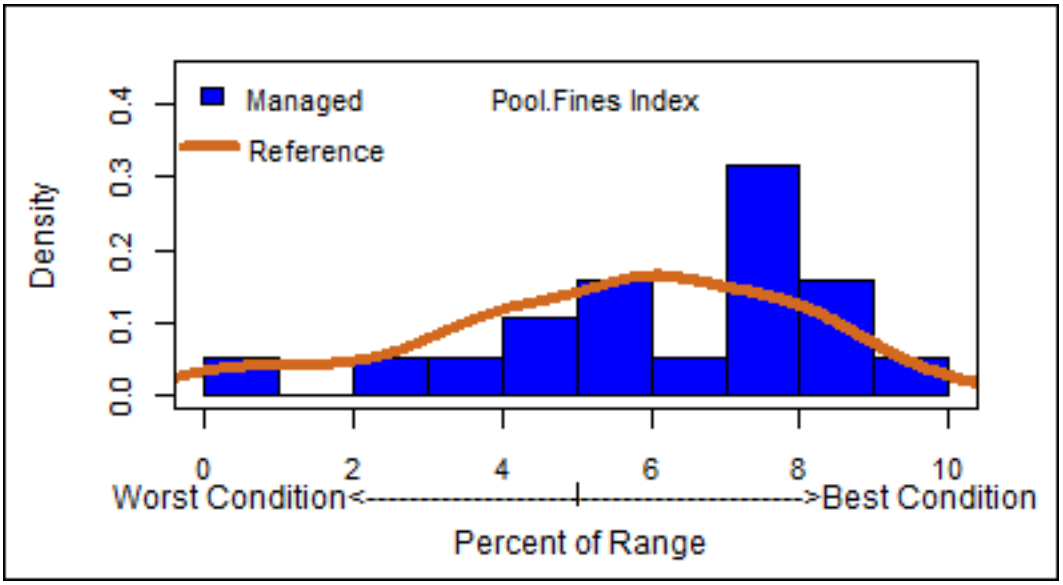

Figure 10. Pool Fines < 6 mm Index values across the St. Joe. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

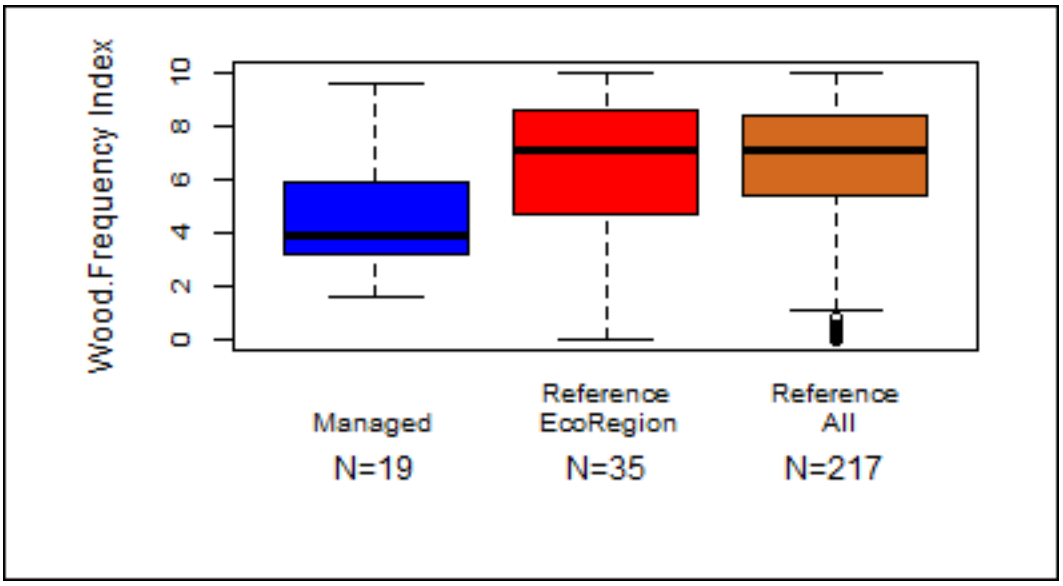

Figure 11. Wood Frequency Index values across the St. Joe. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

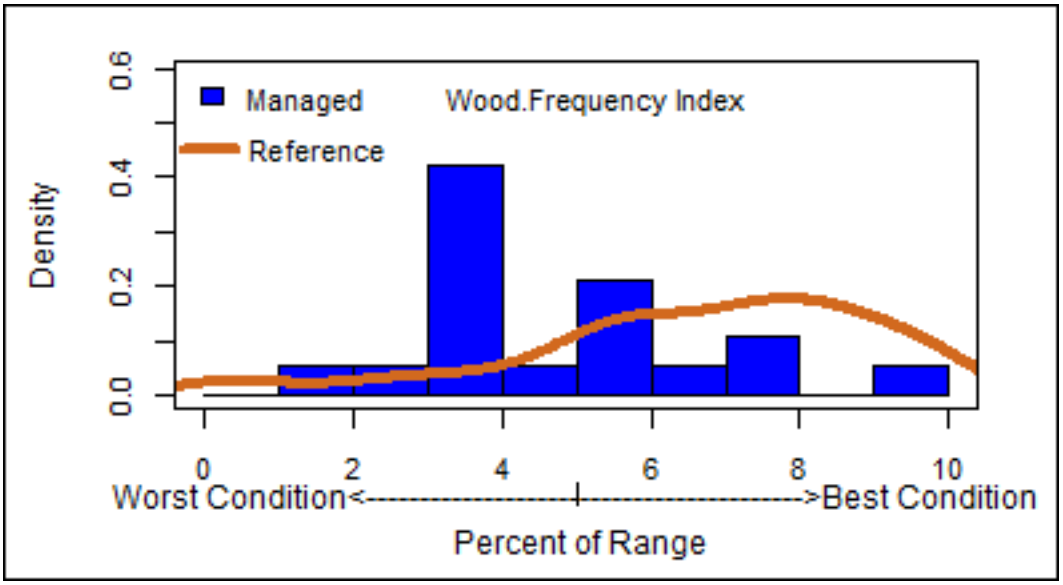

Figure 12. Wood Frequency Index values across the St. Joe. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

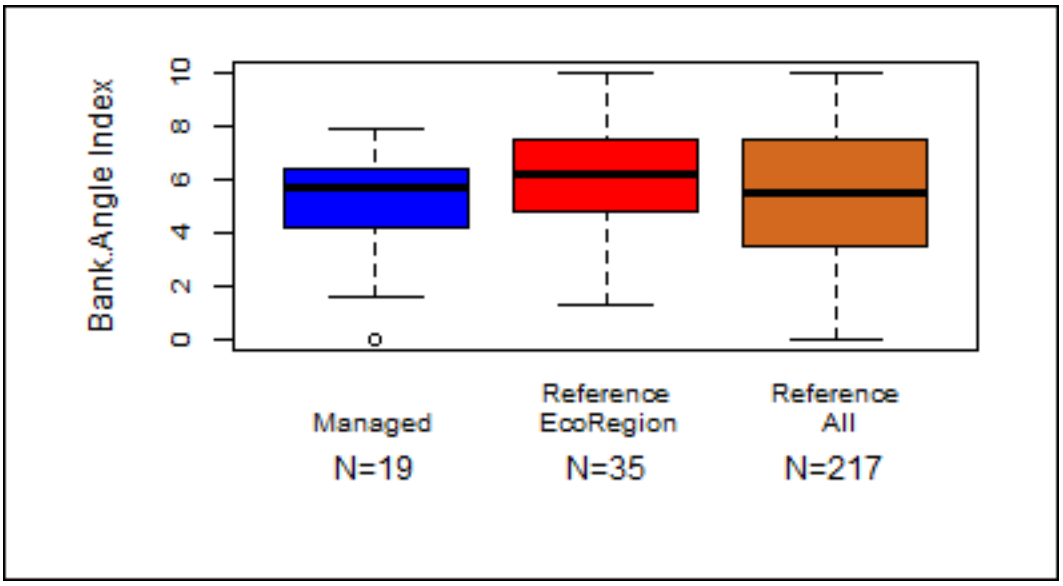

Figure 13. Bank Angle Index values across the St. Joe. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

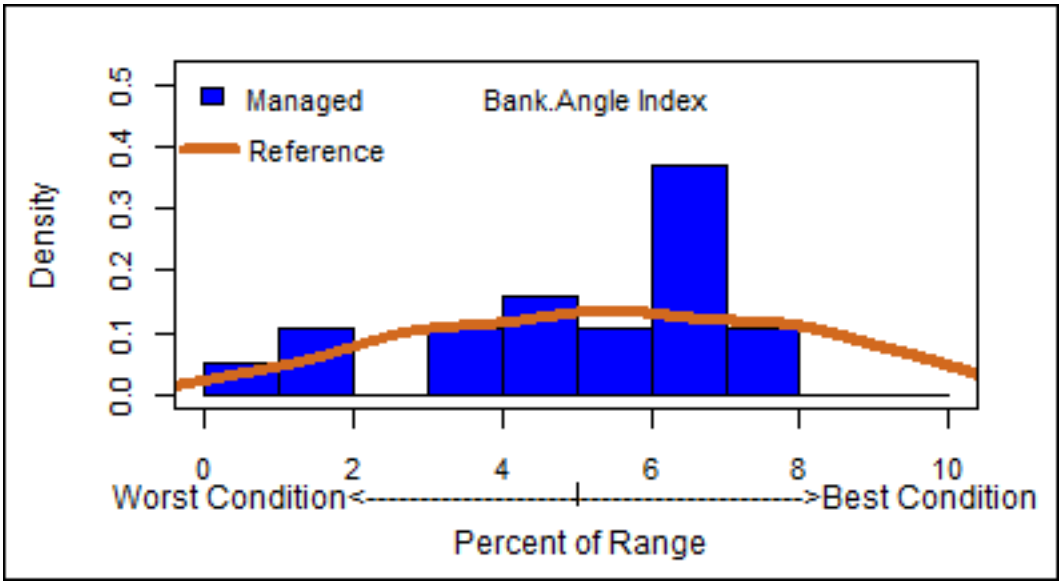

Figure 14. Bank Angle Index values across the St. Joe. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

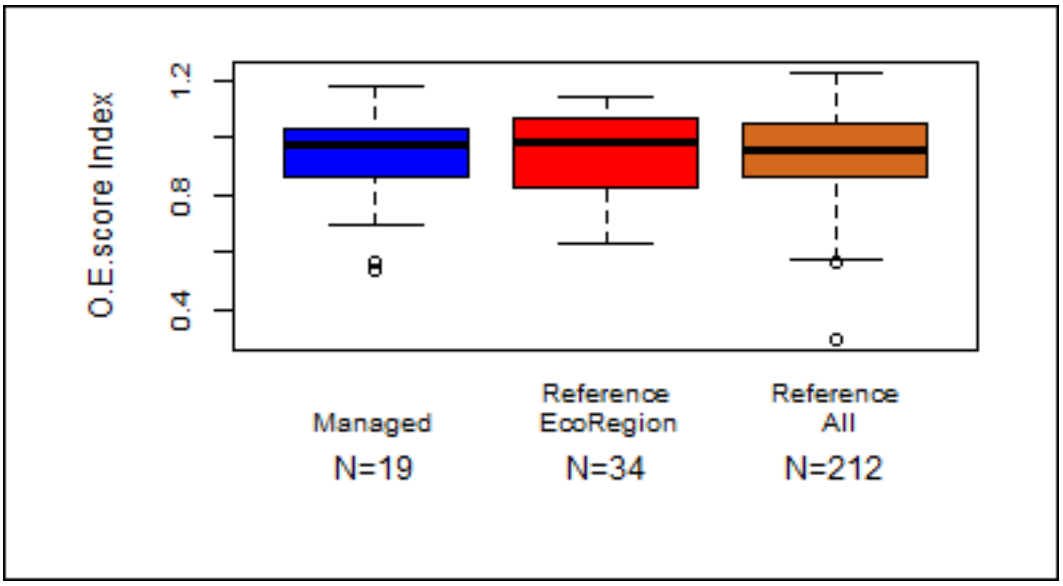

Figure 15. O/E Macroinvertebrate score Index values across the St. Joe. Median and range of index values for managed sites, reference sites within the ecoregion, and reference sites for the entire PIBO study area.

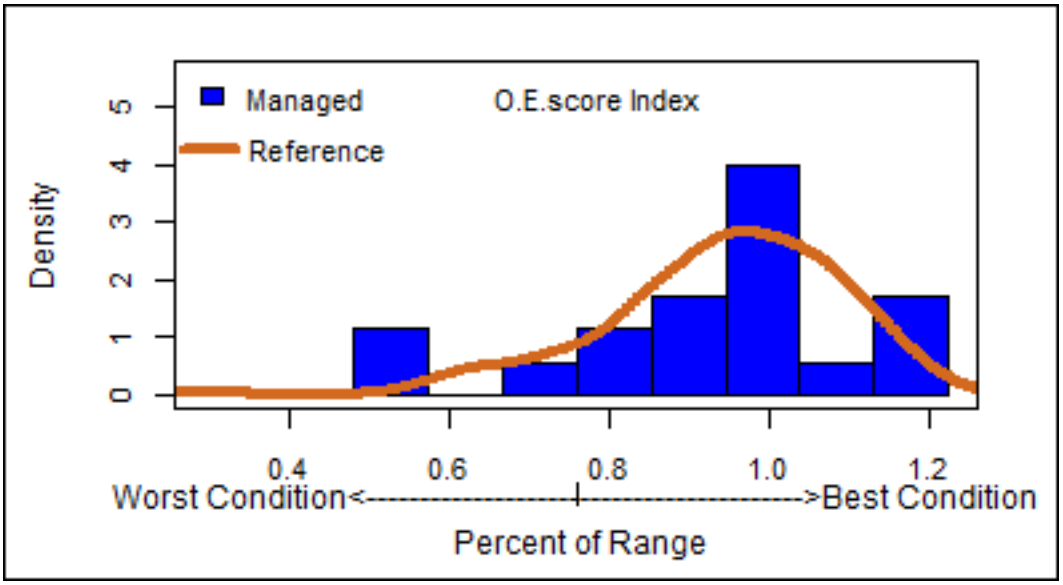

Figure 16. O/E Macroinvertebrate score Index values across the St. Joe. Distribution of index values for managed reaches (histogram) compared to expected values at reference reaches (the line graph). Close matches between histogram height and line indicate conditions are similar at managed and reference reaches.

Table1. Summary of Index Scores--St. Joe; N=sample size, p-value=significance (0.05), sd=standard deviation, ci=95% confidence interval

InterestArea	Metric	Indexscore	N	pvalue	sd	ci
Managed	Overall	43.22	19	NA	15.08	6
Reference Local	Overall	NA	<3	NA	NA	NA
Reference Eco Region	Overall	51.68	34	0.077	18.31	5.32
Reference All	Overall	52.02	216	0.024	16.69	1.88
Managed	Residual.Pool.Depth	4.16	19	NA	2.35	0.94
Reference Local	Residual.Pool.Depth	NA	<3	NA	NA	NA
Reference Eco Region	Residual.Pool.Depth	5.23	35	0.15	2.87	0.82
Reference All	Residual.Pool.Depth	5.41	217	0.037	2.4	0.27
Managed	Pool.Percent	3.68	19	NA	2.14	0.85
Reference Local	Pool.Percent	NA	<3	NA	NA	NA
Reference Eco Region	Pool.Percent	4.81	35	0.099	2.73	0.78
Reference All	Pool.Percent	4.93	217	0.024	2.49	0.28
Managed	Median.Substrate	6.48	19	NA	2.88	1.14
Reference Local	Median.Substrate	NA	<3	NA	NA	NA
Reference Eco Region	Median.Substrate	5.84	35	0.403	2.08	0.59
Reference All	Median.Substrate	5.56	217	0.194	2.51	0.28
Managed	Pool.Fines	6.18	19	NA	2.36	0.94
Reference Local	Pool.Fines	NA	<3	NA	NA	NA
Reference Eco Region	Pool.Fines	5.25	34	0.159	2.01	0.58
Reference All	Pool.Fines	5.49	216	0.237	2.39	0.27
Managed	Wood.Frequency	4.76	19	NA	1.97	0.78
Reference Local	Wood.Frequency	NA	<3	NA	NA	NA
Reference Eco Region	Wood.Frequency	6.09	35	0.056	3	0.86
Reference All	Wood.Frequency	6.62	217	p<0.01	2.38	0.27
Managed	Bank.Angle	5.09	19	NA	2.13	0.85
Reference Local	Bank.Angle	NA	<3	NA	NA	NA
Reference Eco Region	Bank.Angle	5.94	35	0.183	2.35	0.67
Reference All	Bank.Angle	5.45	217	0.487	2.54	0.29
Managed	O.E.score	0.93	19	NA	0.18	0.07
Reference Local	O.E.score	NA	<3	NA	NA	NA
Reference Eco Region	O.E.score	0.95	34	0.682	0.14	0.04
Reference All	O.E.score	0.94	212	0.76	0.15	0.02

Trend

Table 2 .Trend in stream habitat attributes across the St. Joe Subbasin including: Overall_Index score, O.E. (Observed/Expected macroinvertebrate score), VegStab (bank stability), UnCutPct (percent undercut banks), LWFrq (large wood frequency), Bank Angle, PTFines6 (percent fines in pool tails), D50 (median substrate size), RPD (residual pool depth), and PoolPct (percent pools). Refer to page 5 of methods (Heading: 'Summary Tables') for further explanation. Time1 = mean during first visit; Time2 = mean value for last visit; Percent Change = Percent change in the mean values between the first and last visit; Sample size = number of observations with repeat visits; Negative Number = Number of sites where actual measurement was lower on last visit; Positive Number = Number of sites where actual measurement was higher in last visit; None Number = Number of sites where last visit and first visit values were equal; P-value = Significance test; Desired Direction = direction of change in the mean, which can be either + or -; Actual Change = actual direction of change in the mean, which can be not statistically significant (NS), + or -.

Metric	Time1 Value	Time2 Value	Percent Change	Sample Size	Negative Number	Positive Number	No Change Number	P-value	Desired Direction	Actual Change
Overall_Index	40.86	47.69	16.7	19	2	17	0	0.01	+	+
O.E.	0.9	0.94	4.4	19	7	12	0	0.277	+	NS
VegStab	84.7	91.69	8.3	19	5	14	0	0.067	+	+
UnCutPct	25.12	25.53	1.6	19	9	10	0	0.809	+	NS
LWFrq	139.28	165.4	18.7	19	6	13	0	0.147	+	NS
BankAngle	117.26	117.68	0.4	19	8	9	2	0.586	-	NS
PTFines6	14.98	15.32	2.3	19	9	9	1	0.647	-	NS
D50	0.0746	0.0884	18.4	19	7	11	1	0.215	+	NS
RPD	0.4	0.34	-14.2	19	11	8	0	0.277	+	NS
PoolPct	34.32	45.41	32.3	19	5	14	0	0.03	+	+

Lower N.F. Clearwater

Status

Not enough managed sites for:

metric	sample size
Overall	4
Residual.Pool.Depth	4
Pool.Percent	4
Median.Substrate	4
Pool.Fines	4
Wood.Frequency	4
Bank.Angle	4
O.E.score	4

Trend

Not enough managed sites for trend

Upper Spokane

Status

Not enough managed sites for:

metric	sample size
Overall	3
Residual.Pool.Depth	3
Pool.Percent	3
Median.Substrate	3
Pool.Fines	3
Wood.Frequency	3
Bank.Angle	3
O.E.score	3

Trend

Not enough managed sites for trend

S.F. Coeur d'Alene

Status

Not enough managed sites for:

metric	sample size
Overall	1
Residual.Pool.Depth	1
Pool.Percent	1
Median.Substrate	1
Pool.Fines	1
Wood.Frequency	1
Bank.Angle	1
O.E.score	1

Trend

Not enough managed sites for trend

Lower Clark Fork

Status

Not enough managed sites for:

metric	sample size
Overall	1
Residual.Pool.Depth	1
Pool.Percent	1
Median.Substrate	1
Pool.Fines	1
Wood.Frequency	1
Bank.Angle	1
O.E.score	1

Trend

Not enough managed sites for trend

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